ASSOCIATION MILITARY SURGEONS UNITED STATES

ORGANIZED 1891

PRO PATRIÆ

RE-ORGANIZED 1893

COL. CHARLES HENRY ALDEN,
Asst. Surgeon General U. S. A. President 1899-1900.

PROCEEDINGS OF THE NINTH ANNUAL MEETING

OF

THE ASSOCIATION

OF

MILITARY SURGEONS

OF

THE UNITED STATES

HELD AT

NEW YORK CITY

MAY 31, JUNE 1 AND 2, 1900

CHICAGO
R. R. DONNELLEY & SONS CO.
1901

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Surgeon N. G., Mo.

NOMINATING AND AUDITING COMMITTEES.

To be appointed at the next Annual Meeting.

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OF THE

ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES

HELD AT NEW YORK, N. Y., MAY 31, JUNE 1 AND 2, 1900.

MINUTES OF THE MEETING.

NINTH ANNUAL MEETING OF THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES, HELD IN NEW YORK, N. Y., MAY 31, JUNE 1, 2, 1900.

The following were present during the meeting :

Col. Charles H. Alden	U. S. A. (Ret.)
Col. W. McWatters	R. A. M. C.
Maj. C. M. Robertson	Late U. S. V.
Maj. A. H. Briggs	N. G., N. Y.
Lt.-Col. Charles Adams	I. N. G.
Lieut. S. C. Stanton	I. N. G.
Col. J. D. Griffith	Mo. N. G.
Capt. Chas. M. Gandy	U. S. A.
Col. Wm. J. Maybury	N. G., Me.
Brig.-Gen. A. J. Stone	N. G., Minn.
Maj. T. J. Sullivan	I. N. G.
P. A. Surg. C. P. Wertenbaker	U. S. M.-H. S.
Lieut. Thos. S. Burbank	N. R., N. C.
Surgeon G. T. Vaughan	U. S. M.-H. S.
Maj. H. S. Kilbourne	U. S. A.
Lt.-Col. N. S. Jarvis	N. G., N. Y.
Maj. A. A. Wesley	Late U. S. V.
Lt.-Col. C. F. W. Myers	N. G., N. J.

Col. S. M. Welch, Jr.	N. G., N. Y.
Maj. Henry Richings	I. N. G.
Brig.-Gen. J. Francis Calef	N. G., Conn.
Maj. C. C. Wiley	Penn. N. G.
Lt.-Col. Leonard B. Almy	N. G., Conn.
Maj. Julian La Pierre	N. G., Conn.
Lieut. H. A. Arnold	N. G., Penn.
Maj. W. S. Stewart	N. G., Penn.
Col. Nicholas Senn	I. N. G.
Maj. W. F. Southard	Late M. V. M.
Capt. F. W. Smith	N. G., W. Va.
Brig.-Gen. J. T. Priestley	N. G., Ia.
Lieut. John Hamilton	Late U. S. V.
Capt. Myles Standish	M. V. M.
Capt. John C. Wise	U. S. N.
Capt. Geo. J. Newgarden	U. S. A.
Lt.-Col. R. J. Fitz Gerald	N. G., Minn.
Maj. Thomas C. Clark	N. G., Minn.
Lt.-Col. William H. Devine	M. V. M.
Brig.-Gen. R. A. Blood	M. V. M.
Brig.-Gen. Jno. B. Edwards	Wis. N. G.
Maj. Joe Whiting	Wis. N. G.
Capt. G. W. Woods	U. S. N.
Maj. H. L. Dearing	M. V. M.
Brig.-Gen. Patrick Cassidy	N. G., Conn.
Capt. W. C. Borden	U. S. A.
Lt.-Col. Otis H. Marion	M. V. M.
Lieut. J. Mark Peters	N. G., Penn.
Lieut. G. G. Harman	N. G., Penn.
Capt. Wm. A. Rolfe	M. V. M.
Maj. Eduard Boeckmann	Late U. S. V.
Maj. Andrew S. Stayer	N. G., Penn.
Capt. Jesse Rowe	I. N. G.
Maj. Geo. B. Cowell	N. G., Conn.
Brig.-Gen. C. A. Wheaton	N. G., Minn.
Lieut. F. L. Pleadwell	U. S. N.
Maj. N. del Rio	C. M. M. M.
Maj. W. H. Daly	Late U. S. V.
Maj. Charles E. Bruce	N. G., N. Y.
Capt. A. B. Jarrett	N. G.. N. Y.
Lieut. C. H. Miner	N. G., Penn.
Lt.-Col. A. A. E. McCandless	N. G., Penn.
Capt. Geo. Peck	U. S. N.
Maj. S. C. Milligan	N. G., Penn.
Capt. Karl A. Emmerling	N. G., Penn.
Lieut. Harry P. Ritchie	N. G., Minn.

Brig.-Gen. A. W. Phillips	N. G., Conn.
Maj. W. G. B. Harland	N. G., Penn.
Maj. Azel Ames	Late U. S. V.
Capt. James P. Warbasse	N. G., N. Y.
Maj. Louis L. Seaman	Late U. S. V.
Maj. J. K. T. Van Pelt	Late U. S. V.
Ensign D. M. Trecartin	N. R., Conn.
Capt. D. C. Howard	U. S. A.
Maj. J. M. Banister	U. S. A.
Maj. N. D. Harvey	R. I. M.
Maj. Enno Sander	Late N. G., Mo.
Maj. Geo. Bayles	N. G., N. J.
Maj. C. C. Foster	M. V. M.
Lt.-Col. W. S. Watson	N. G., Conn.
Maj. Morris F. Cawley	N. G., Penn.
Maj. Geo. Halley	N. G., Mo.
Lieut. Henry Morris	Late N. G., Pa.
Lieut. Robt. E. Bell	M. V. M.
Lieut. Wm. M. Angney	N. G., Penn.
Col. John V. Shoemaker	N. G., Penn.
Maj. Joseph H. Townsend	N. G., Conn.
Lt.-Col. J. M. Barstow	N. G., Ia.
Col. C. C. Byrne	U. S. A.
Maj. H. P. de Forest	N. G., N. Y.
Lieut. A. F. Brugman	N. G., N. Y.
Maj. Henry Allers	N. G., N. J.
Capt. John H. Huddleston	N. G., N. Y.
Lt.-Col. Freeman C. Hersey	M. V. M.
Capt. E. B. Frick	U. S. A.
Maj. R. W. Montelius	N. G., Penn.
Lieut. F. E. Drumheller	N. G., Penn.
Maj. Henry Wallace	Late U. S. V.
Capt. Wm. N. Belcher	Late N. G., N. Y.
Brig.-Gen. R. B. Warfield	N. G., Md.
Maj. Geo. H. Halberstadt	N. G., Penn.
Maj. A. L. Wright	N. G., Ia.
Brig.-Gen. G. M. Sternberg	U. S. A.
Brig.-Gen. George Cook	N. G., N. H.

Association of Military Surgeons

OF THE UNITED STATES.

MINUTES.

PROCEEDINGS OF THE NINTH ANNUAL MEETING OF THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES, HELD AT NEW YORK CITY, MAY 31, JUNE 1-2, 1900.

FIRST DAY, MORNING SESSION, MAY 31.

The Association convened in Hosack Hall, New York Academy of Medicine, and was called to order by the President, Col. Chas. H. Alden.

Major A. H. Briggs, Buffalo, N. Y., delivered the following

ADDRESS OF WELCOME.

Mr. President and Members of the Association:

It is with great regret that I have to announce the absence of our Governor, the Honorable Theodore Roosevelt, whom we had expected to be present to welcome the Association to this city, but circumstances, over which he had no control, prevented him from being here to-day. This pleasing duty, therefore, falls on me as the representative of the National Guard of the Empire State. We bid you welcome, gentlemen, and assure you that we will endeavor to make your visit to New York pleasant.

Arrangements have been made for an annual dinner. I speak advisedly when I say "annual," as we wish to make it an annual event hereafter, so that we can renew old acquaintance and talk over old times. The dinner will begin to-morrow evening at 7:30, and those who wish to attend will please leave their names with the Secretary or Assistant Secretary. The printed program, of which you no doubt all have a copy, gives you further information in regard to the points of interest in this city and vicinity, such as Governor's Island, Brooklyn Naval Hospital, West Point Military Academy, a trip on the United States steamer around the harbor, etc. The University and the Army

and Navy Clubs of this city extend invitations to you to visit their houses.

Once again, gentlemen of the Association, I bid you welcome, and I hope that your sojourn here will be a pleasant one.

As Chairman of the Committee on Transportation, Major Briggs called the attention of the members to the fact that in order to procure the one and one-third rate granted by all the passenger associations, except that of the New England States, certificates must be handed in at once as the Trunk Line Agent will arrive in New York on Friday and will remain one day only. The one-third return fare will be granted only when 100 certificates have been handed in.

The Secretary, Lt.-Col. Chas. Adams, read his report, which was accepted.

The Treasurer, Lt. H. A. Arnold, presented his report, which, upon motion, was referred to the Auditing Committee.

On motion, the thanks of the Association were extended to the Treasurer for his gratifying report of the financial condition of the Association.

The Chair appointed the following Auditing Committee: Gen. J. T. Priestley, Iowa; Col. L. B. Almy, Connecticut; Major T. C. Clark, Minnesota.

Col. Chas. H. Alden presented the report of the Executive Committee.

On motion of Major T. C. Clark, Minn., the report of the committee was adopted.

Brig.-Gen. J. F. Calef, Conn., Chairman of the Literary Committee, reported and offered the program, as printed, as the result of the labor of the committee. On motion the report was accepted.

Lt.-Col. Chas. Adams, Chairman of the Publication Committee, reported that the proceedings of the Kansas City meeting were in type, ready for revision, and that the transactions would be ready for distribution very soon.

Lt.-Col. Chas. Adams presented a report for the Committee on Necrology, which, on motion, was accepted.

The Committee on Enno Sander Prize Essay, on request, was given further time to report.

The President then introduced Surg.-Col. Wm. McWatters, R. A. M. C., of Halifax, N. S.; Major Narciso del Rio of the Military Hospital at Vera Cruz, Mexico, and Col. Nicholas Senn, the founder of the Association.

Lt.-Col. J. D. Griffith, Mo., took the chair, and Col. Alden delivered the President's address.

Major W. H. Daly, Pa., moved that the recommendations in the President's address, in regard to an Association Journal, be referred to a committee, which shall present a preliminary report at this meeting and a further report at the next annual meeting.

This motion was discussed by Lt.-Col. J. D. Griffith, Mo., who said: The only obstacle seems to be the large number of journals we already have, but I hope that our Transactions are to be continued in book form no matter what is done with the journal question. If a copy of the journal is lost, the volume is incomplete, whereas the Transactions are always complete and reliable.

MAJOR W. H. DALY, Pa.—I had two reasons for making my motion: First, the advertisements will almost pay for the journal, and, second, there will be a wider dissemination of very useful matter. Transactions are a good thing for reference, but a tomb for any paper published therein.

COL. N. SENN, Ill.—I heartily endorse the establishment of a journal. This question arose a few years ago and almost became a fact. Our object should be to bring our Transactions before a large audience and a journal, as proposed, will be subscribed to by all foreign institutions, so that our Transactions will cross the ocean. The Transactions can be secured at very small expense in the form of an annual report, excluding all other matter, except what is brought directly before the Association, so that there should be no objection to passing on this matter favorably.

GEN. A. J. STONE, Minn.—I cannot add anything to what has already been so well said. We certainly get a larger audience by publishing our papers and Transactions in a journal and we receive the Transactions and literature while fresh. At a minimum expense they can be reprinted from the journal and placed in a bound volume of the Transactions for distribution to members of the Association. I have heard the matter discussed at length by individual members and the consensus of opinion has been that the journal would not only be of value to the Association, but to a large number of medical men interested in military surgery, who desire it as an aid in general every-day practice. I hope Major Daly's motion will prevail.

MAJOR W. F. SOUTHARD, Cal.—My sentiments are in accord with all that has been said. I have had several years' experience in editing medical journals and I know that what the medical profession demands is freshness of news. If we can place the proceedings and papers before the medical profession in a fresh way and as rapidly as possible, I believe it will do much good. As has been truly said, the profession at large takes a great deal

of interest in the work of this Association. There is not a man in general practice to whom the work of this Association is not of inestimable value. We must not forget that in this age of activity, news becomes old and stale when received weeks or months afterward. We want it while it is news.

MAJOR W. H. DALY, Pa.—You will find another result will follow. If you place the journal in the hands of an able committee, there will be an abundance of papers offered and you can also publish a better quality of papers. No one likes to spend time and money preparing a paper and then have it buried between two paste-board covers.

BRIG.-GEN. J. F. CALEF, Conn.—I believe a journal will provide us with a permanent literary committee or at least a permanent chairman, so that he can keep in constant touch with the members, especially the Army and Navy officers who are constantly changing their places of residence. We could also get much better papers in that way than if the committee is appointed annually.

CAPT. W. C. BORDEN, U. S. A.—I think a journal is very much to be desired, as the publication of many very interesting and important papers will be hastened. It would also be desirable to have the papers published at the same time in other journals so that they will not be restricted to a certain class of readers. I have no doubt whatever that the journal will pay, provided you get a good editor, and I know such a man can be found.

MED. DIR. JOHN C. WISE, U. S. N.—I have no doubt that a great deal can be realized by a journal. "Festina lente" is a good motto in this connection, however. Do not let us bring forth a puny journal, but let us have the material to bring forth something that is virile and strong. I must agree with Col. Griffith that to me it is much more satisfactory to read the papers collectively in a book than to read them one at a time in a journal. I would rather read text-books at any time than journals. I do not want to see this Association committed to the publication of a journal without very careful consideration of the matter.

COL. N. SENN, Ill.—The question now before the Association is on the appointment of a committee to look into this matter and I see no reason, therefore, for not acting on the motion as made. I would suggest that the committee represent the different branches of the service.

The motion was put and carried.

On motion of Major W. H. Daly, Pa., it was decided that gentlemen desiring the floor should announce their names and titles if not immediately recognized by the Chair.

Lt.-Col. J. D. Griffith, Mo., made commendatory reference to

the long and meritorious service rendered to the United States by the President, Col. Chas. H. Alden.

The President thanked the Association for its approval of his work.

Brig.-Gen. J. T. Priestley, Iowa, reported the substitution of Major W. S. Stewart, Pa., for Major T. C. Clark, Minn., on the Auditing Committee and presented the report of the committee, which, on motion, was accepted.

On motion an adjournment was taken until 2 p. m.

First Day, Afternoon Session.

Association called to order at 2 p. m. by the President.

Med. Dir. Geo. W. Woods, U. S. N., invited the Association to visit the Naval Hospital at Brooklyn on Saturday afternoon at one o'clock.

Major J. M. Banister, U. S. A., extended an invitation to the members to visit West Point at any time convenient to them.

Lt.-Col. J. D. Griffith, Mo., reported that the Committee on the Enno Sander Prize Essay, after carefully examining the papers presented in competition for the medal, was of the unanimous opinion that the writer with the *nom de plume* " Edro " was entitled to the award. The essays by " Quercus " and " Semper paratus " were recommended to receive honorable mention.

The author of the successful essay was found to be Capt. W. C. Borden, U. S. A., Washington, D. C., and the medal was presented to him by the President.

On motion of Lt.-Col. J. D. Griffith, Mo., the three papers were referred to the Publication Committee.

The President then appointed the following Committee on Publication of an Association Journal:

Brig.-Gen. A. J. Stone, Minn.; Lt.-Col. Charles Adams, Ill.; Capt. W. C. Borden, U. S. A.; Med. Dir. John C. Wise, U. S. N., and P. A. Surgeon Wertenbaker, U. S. M.-H. S.

On motion of Col. N. Senn, Ill., an invitation to attend the dinner of the Association was extended to the officers of the New York Academy of Medicine in recognition of their courtesy to the Association.

The literary program was then taken up and the following papers were read and discussed:

1. " What Should Be the Standard of Vision Required of Enlisted Men in the United States Army? " by Capt. Myles Standish, M. V. M.

2. " To What Extent Should the Military Surgeon Be Required to Invade the Realm of Ophthalmology? " by Major J. M. Banister, U. S. A.

3. "The Hygiene of Camps of Instruction," by Major Julian La Pierre, C. N. G. (Ret.).

4. "The Value of the Schumburg Method of Purification of Water for Military Purposes," by Capt. John H. Huddleston, N. G., N. Y.

5. "Some Experiences and Suggestions," by Major W. G. B. Harland, N. G., Pa.

6. "Field Work in the Philippines," by Lieut. F. M. Kemp, U. S. A.

On motion, the papers read were referred to the Publication Committee.

On motion, the Association adjourned until 9:30 a. m. Friday.

SECOND DAY, MORNING SESSION.

The Association met at 10 a. m. and was called to order by the President.

President Alden asked the state delegations to select one of their number as representative on the Nominating Committee, in order that on calling the roll of states the representative's name could be announced.

Brig.-Gen. Geo. Cook, N. G., N. H. (Ret.), First Vice-President, was called to the chair.

The Executive Committee reported that the following applicants had been elected to membership:

ACTIVE MEMBERS.

Cass Grove Barns, Colonel and Surgeon-General, N. N. G.
George Carlton Berkley, Major and Surgeon, V. N. G.
Arthur Henry Bogart, Capt. and Asst. Surg., N. G., N. Y.
William F. Brokaw, Lieut. and Surgeon, N. B., O. N. G.
Thomas Sparrow Burbank, Lieut. and Surgeon, N. R., N. C.
James David Iglehart, Capt. and Asst. Surgeon, N. G., Md.
John Cowell MacEvitt, Lieut. and Surgeon, N. M., N. Y.
George William Mahoney, Capt. and Asst. Surgeon, I. N. G.
Thomas Brown McClintic, Asst. Surgeon, U. S. M.-H. S.
Ralph W. Montelius, Major and Surgeon, N. G., Pa.
John Miller Moore, Lieut. and P. A. Surgeon, U. S. N.
Edward Lyman Munson, Capt. and Asst. Surgeon, U. S. A.
Jacob Mark Peters, 1st Lieut. and Asst. Surgeon, N. G., Pa.
George Frederick Potteiger, 1st Lieut. and Asst. Surgeon, N. G., Pa.
Harry Parks Ritchie, 1st Lieut. and Asst. Surg., N. G. S. M.
William Henry Rothert, Captain and Asst. Surgeon, O. N. G.
Jesse Rowe, Captain and Asst. Surgeon, I. N. G.

Orange S. Runnels, Colonel and Surgeon-General, Ind. N. G.
Wm. Nicholas Senn, 1st Lieut. and Asst. Surgeon, I. N. G.
Thomas Bray Spence, Capt. and Asst. Surgeon, N. G., N. Y.
James P. Warbasse, Capt. and Asst. Surgeon, N. G., N. Y.

ASSOCIATE MEMBERS.

Benjamin Brooke, Capt. and Asst. Surgeon (Ret.), U. S. A.
Edwin Geer, Lieut. and Surgeon, N. M., Md.
John Franklin Robinson, Maj. and Surgeon (Ret.), N. H. N. G.
Louis L. Seaman, Major and Surgeon (Ret.), U. S. V. Eng.
William E. Wirt, Lieut.-Commander, N. B., O. N. G.

The President announced that a further report on applications still in the hands of the Secretary would be presented later.

On motion, the gentlemen whose names had been proposed for membership were allowed the privilege of the floor.

The following papers were read and discussed:

"The Transportation of Wounded on Shipboard, with Special Reference to the Invention of Commander Mahan," by Medical Director C. U. Gravatt, U. S. N., read by Med. Dir. John C. Wise, U. S. N.

"A Method of Transportation of Wounded on Ships of War," by Med. Dir. John C. Wise, U. S. N.

"An Emergency Field Litter or Cot," by Capt. Geo. J. Newgarden, U. S. A.

"The Primary Antiseptic Dressing of Wounds with a Consideration of Subsequent Treatment," by Major Thos. J. Sullivan, I. N. G.

"The Management of Quarantinable Diseases and Sanitary Cordons," by P. A. Surgeon C. P. Wertenbaker, U. S. M.-H. S.

On motion, these papers were referred to the Publication Committee.

On motion, the paper by Lt.-Col. A. A. Woodhull, U. S. A., on "General Hospitals" was referred to the Publication Committee.

On motion, the Association adjourned until 2 p. m.

Second Day, Afternoon Session.

The Association met at 2 p. m. and was called to order by the President.

The Committee on Journal reported as follows:

The committee on the practicability of publishing a journal begs leave to report that in its opinion, while believing that the publication of a monthly journal can in all probability be success-

fully carried out by the Association, time will be required to mature plans and to secure an editorial staff before a definite scheme can be submitted to the Association.

We would therefore suggest that a committee be appointed to formulate a plan for the management of such a journal, such plan to be presented at the next meeting of the Association.

(Signed) ALEX. J. STONE, Chairman.

On motion of Col. Senn the committee was continued to present a full report at the next meeting of the Association.

The Executive Committee reported favorably on the following applications for membership:

ACTIVE.

Gilbert M. Elliott, 1st Lieut. and Asst. Surgeon, N. G., Me.
Charles H. Miner, 1st Lieut. and Asst. Surgeon, N. G., Pa.
Henry Richings, Major and Surgeon, I. N. G.
Henry Allers, Major and Surgeon, N. G., N. J.
Francis E. Drumheller, Lieut. and Asst. Surgeon, N. G., Pa.
Joe Whiting, Major and Surgeon, Wis. N. G.

ASSOCIATE.

John Frederick Haller, 1st Lieut. (Ret.), R. I. M.
John Hamilton, 1st Lieut. and Asst. Surgeon, N. G., Ia.

On motion, the applicants were duly elected to membership.

The following Nominating Committee was appointed by the Chair:

Capt. W. C. Borden, U. S. A.
Major W. F. Southard, Cal.
Brig.-Gen. J. F. Calef, Conn.
Major T. J. Sullivan, Ill.
Brig.-Gen. J. T. Priestley, Iowa.
Col. W. J. Maybury, Maine.
Surgeon C. O. Wertenbaker, U. S. M.-H. S.
Brig.-Gen. R. B. Warfield, Md.
Lt.-Col. O. H. Marion, Mass.
Major T. C. Clark, Minn.
Lt.-Col. J. D. Griffith, Mo.
Med. Dir. John C. Wise, U. S. N.
Brig.-Gen. Geo. Cook, N. H., Chairman.
Lt.-Col. C. F. W. Myers, N. J.
Lt.-Col. N. S. Jarvis, N. Y.
Lieut. T. S. Burbank, N. C.
Major G. H. Halberstadt, Pa., Secretary.
Major N. D. Harvey, R. I.
Captain F. W. Smith, W. Va.
Brig.-Gen. J. B. Edwards, Wis.

The following papers were read:

"Some Observations Made during My Service in the Spanish-American War," by Lieut. R. E. Bell, M. V. M.

"Spanish-American War as Seen by the Military Surgeon," by Major Allen G. Wesley, I. N. G.

"Some Experiences of the Volunteer Surgeon in the Philippines," by Major R. J. Fitzgerald, N. G., Minn.

"The Utilization of Native Troops in Colonial Possessions," by Major Louis L. Seaman, U. S. V. (Ret.).

"The Diagnosis and Treatment of Gun-shot Wounds of the Abdomen," by Surgeon G. T. Vaughan, U. S. M.-H. S., and an abstract of a paper on

"Sick Soldiers in Philadelphia After the Late War with Spain," by Col. John V. Shoemaker, N. G., Pa.

On motion, the various papers read were referred to the Publication Committee.

On motion, an adjournment was taken until Saturday morning at 9 o'clock.

THIRD DAY, MORNING SESSION.

The Association convened at 9:30 a. m., the President in the Chair.

The following papers were read:

"The Mortality of War Wounds with Tentative Conclusions Relative to Modern Weapons and Surgical Methods," by Capt. W. C. Borden, U. S. A.

"Tetanus in the Army," by Major Narciso del Rio, Vera Cruz, Mexico. (Read by Lt.-Col. Griffith.)

On motion, the papers were referred to the Publication Committee.

On motion, the thanks of the Association were extended to Major del Rio for his valuable and instructive paper.

On motion, all the papers on the program still unread were referred to the Publication Committee.

The applications for membership of the following were reported upon favorably by the Executive Committee:

ACTIVE MEMBERS.

H. W. Austin, Surgeon, U. S. M.-H. S.
Harlow Brooks, Capt. and Asst. Surgeon, N. G., N. Y.
George W. Stoner, Surgeon, U. S. M.-H. S.
George Tully Vaughan, Surgeon, U. S. M.-H. S.
William H. Wilson, Capt. Med. Dept., U. S. A.

ASSOCIATE MEMBERS.

Henry Ernshaw Gettier, Lieut. and Acting Asst. Surgeon (Ret.), U. S. A.

George Bolling Lee, Acting Asst. Surgeon, 7th Army Corps, 2nd Div. Hosp.

Major Narciso del Rio, C. M. M. M., Vera Cruz, and Lt.-Col. J. L. Hubert Neilson, Director-General, Canadian Medical Staff, Ottawa, Canada, were recommended for corresponding membership.

On motion, the various applicants for membership and the gentlemen recommended for corresponding membership were duly elected.

Lt.-Col. J. D. Griffith then read the report of the Nominating Committee, as follows:

The Nominating Committee begs leave to report as follows:
For President, Brig.-Gen. A. J. Stone, N. G., Minn.
First Vice-President, Med. Dir. J. C. Wise, U. S. N.
Second Vice-President, Brig.-Gen. J. F. Calef, N. G., Conn.
Secretary, Lt.-Col. Chas. Adams, I. N. G.
Treasurer, Lieut. H. A. Arnold, N. G., Pa.
Place of meeting, St. Paul, Minn., or San Francisco, Cal.
On motion the report of the committee was accepted.

Brig.-Gen. A. J. Stone invited the Association to meet at St. Paul and presented invitations from the Governor of Minnesota, the Mayor of St. Paul and various business associations and medical societies of St. Paul.

Major Southard asked that San Francisco be the next place of meeting.

Col. Senn moved that San Francisco be selected.

Major Ames moved to amend the motion by substituting St. Paul for San Francisco. Seconded.

After some discussion the amendment was carried, and St. Paul was selected as the next place of meeting.

The following resolutions were offered by Major Clark:

Resolved, That the thanks of this Association are especially due to Major A. H. Briggs, for his untiring and largely single-handed efforts in making the necessary arrangements for this meeting, in this the chief city of the Empire State.

Resolved, That we extend to our retiring President, Col. C. H. Alden, a sense of our appreciation of the able manner in which he has performed the duties of his office under peculiarly trying circumstances, and that we extend to him our best wishes for his future welfare and happiness.

Resolved, That the thanks of this Association be tendered the New York Academy of Medicine, especially to the Chairman of its Executive Committee, Dr. Abram Jacobi, for the use of its beautiful and commodious building and for the courtesies extended to this Association.

Resolved, That the thanks of this Association be tendered to the Army and Navy Club and to the University Club for the privileges extended by them to this Association.

Resolved, That the thanks of this Association be given to the Murray Hill Hotel for the headquarters furnished for use during this meeting.

Resolved, That the thanks of this Association be tendered to Col. C. C. Byrne and Major J. M. Banister, U. S. A., for invitations extended to members of the Association to visit Governor's Island and the U. S. Military Academy at West Point, and to Medical Director G. W. Woods, U. S. N., for an invitation to visit the U. S. Naval Hospital, Brooklyn.

On motion, the resolutions were adopted.

On motion of Major Briggs, a vote of thanks was extended to the Trunk Line Associations for their courtesy in granting the reduced rate, even though the certificates fell short of one hundred.

Lt.-Col. Griffiths having been called to the chair, the President, Colonel C. H. Alden, spoke as follows:

Mr. Chairman, I have the honor to propose the following amendment to the Constitution:

Amend Section 3, Article II, referring to associate members, by inserting after the words "ex-medical officers of the United States Volunteer service" the words "and ex-medical officers of the Confederate Army and Navy, whose service was honorably terminated."

The chief purpose of the proposed amendment is to make ex-Confederate medical officers eligible to associate membership. In this era of reconciliation, of the reunion of the Blue and the Gray, when we have just dedicated at Antietam a monument common to the memory of those who fell on both sides in the Civil War, when the bodies of the Confederate dead are being gathered into the Arlington National Cemetery, it is eminently proper that surviving ex-Confederate medical officers should be invited to join with us in this National Society of Military Surgeons. This Association is a purely scientific one, and sectional or political feeling has no place in it. The Confederate surgeons were, as we are, students and practitioners of military medicine and surgery and can contribute valuable lessons on the subjects of our common study. But this amendment needs, I am sure, no extended argu-

ment. I find that it is strongly favored by the members with whom I have spoken, and I feel certain it will be unanimously adopted.

MAJOR T. C. CLARK, N. G., Minn.—I most heartily endorse that resolution, as we as doctors have nothing to do with the politics of war and any lingering feeling of animosity would be eradicated by such a graceful act.

MED. DIR. JOHN C. WISE, U. S. N.—Thirty-one years ago I entered the United States Navy, the first *bona fide* Southerner to do so. Medicine is in no sense political, and I most cordially endorse this resolution.

COL. N. SENN, I. N. G.—I am most heartily in favor of this resolution and the sooner we act on it, the better.

On motion, the resolution was adopted unanimously and referred to the Executive Committee.

Col. Alden, after extending his thanks to the members of the Association for their kind assistance during his term as President, appointed Lt.-Col. Griffith to escort the newly elected President to the chair.

Gen. Stone was warmly received, and in accepting the Presidency, said:

Mr. President and Members of the Association:

It is with a great deal of hesitancy that I attempt to thank you for the honor that you have conferred on me. I have no words with which to express my gratitude. It was an honor unsought. Even yesterday afternoon, prior to the meeting of your Nominating Committee, I advised some of my friends, stating that I appreciated the honor of having my name mentioned, to vote for a gentleman who is an old and honored member of this Association.

I fear that you have made a mistake in electing so recent a member to this honorable position. I not only appreciate the honor, but I appreciate the labor of the position, and I accept it only because I believe it a duty to the friends who have so kindly honored me and to the Association which has elected me. With your assistance I will endeavor to make the next year as successful a one as my qualifications will permit.

I thank you for the honor that you have conferred upon my state and the members of my medical corps, for I do appreciate most sincerely that it is an honor not to me individually but to the state that has so many friends in our noble profession. Gentlemen, I thank you.

Major A. S. Stayer, N. G., Pa., offered the following:

WHEREAS, The method of examination of recruits of the National Guard is frequently conducted in an exceedingly careless manner, to the detriment of state or national service;

Therefore, Resolved, That this Association recommend in the strongest language possible that the examination of recruits for the National Guard service of the various states of the Union be conducted with the utmost care, similar to that of the Army, and that books and papers requisite for such examination be provided for use as a matter of record and instruction to the medical officers making such examination.

On motion, the resolution was placed on file for future reference.

Major A. H. Briggs, N. Y., moved that the time of the next meeting be on Thursday, Friday and Saturday, May 23, 24, 25, 1901. Motion lost.

Brig.-Gen. Priestley, Iowa, moved that the arrangement of the time of meeting be left to the Executive Committee.

Col. N. Senn, Ill., moved to amend this motion by substituting "the Thursday, Friday and Saturday of the week prior to the meeting of the American Medical Association." Seconded and carried.

There being no further business to come before the meeting, on motion, the Association adjourned to meet in St. Paul on the last Thursday in May, 1901.

CHARLES ADAMS, Secretary.

REPORTS OF OFFICERS AND COMMITTEES.

I. REPORT OF THE TREASURER.

The Treasurer has the honor to submit, in as brief a manner as possible, such matters appertaining to his office as seem to require consideration.

For the first time in its history the Association Treasurer has furnished a bond. In compliance with Sec. 4, Art. 5 of the By-laws, a bond of suretyship was given by the Merion Title and Trust Company of Ardmore, Pa., in the amount of $2,000.

The period of Associational inactivity during the Spanish war has resulted in numerous arrearages of dues.

Sept. 27, 1899.

55 members owed $15 each.
106 members owed $10 each.
264 members owed $5 each.
1 member had paid dues to date and there were five life members.

No statements of indebtedness having been sent out in January, 1899, the receipts for that year prior to the Kansas City meeting were only $20.

No register of members having been prepared since October, 1897, much difficulty was experienced in ascertaining the address of the different members. It is believed, however, that only two or three of the statements sent out January, 1900, failed to reach those for whom they were intended.

Considerable correspondence ensued owing to a misapprehension on the part of many members relative to the dues for 1898, as they expected exemption because of the failure of the Association to meet that year. These statements and subsequent mollifying letters have borne fruit.

May 28, 1900:—

51 members owe $20 each.
89 members owe $15 each.
122 members owe $10 each.
26 members owe $5 each.
184 members have paid in full to date.

1 member has paid in advance, 6 are life members, 13 membership fees have been paid, but the applications have not yet been acted upon.

The old system of bookkeeping being so cumbersome as to make an audit almost impossible in the limited time at the disposal of the committee, I have devised, and have had made, a specially ruled ledger which overcomes this objectionable feature.

No numerical record of insignia issued has heretofore been kept by the Association. Such a record has been prepared and will serve in future to assist in establishing ownership of any insignia lost or stolen.

Simply as a matter of interest I desire to state that 823 pieces of mail matter have been sent out from the Treasurer's office since Oct. 1, 1899.

All obligations have been promptly met, save only that of printing and distributing the Transactions of the last meeting. That volume is still in the hands of the printer.

REPORT OF RECEIPTS AND EXPENDITURES.

FROM SEPTEMBER 28, 1899 TO MAY 28, 1900.

DEBIT.		
To balance from former Treasurer, Erwin		$1,378.18
To balance from former Secretary, Pilcher		82.26
To receipts from Dues		1,834.00
To receipts from Membership Fees		250.00
To receipts from sale of Transactions		23.75
To receipts from sale of Insignia and Buttons		94.00
To receipts from interest on deposits to March 31, 1900		10.66
Total		$3,672.85
CREDIT.		
By cash for Printing and Stationery	$ 18.00	
By cash for Ledger and Journal	7.05	
By cash for Bond of Suretyship	15.50	
By cash for Rent of Safe Deposit Box	3.00	
By cash for Stenographer, Kansas City Meeting	115.00	
By cash for Postage and Internal Revenue Stamps	23.60	
By cash for Freight, Hauling, and Handling Books	20.44	
By cash for Storage of Books, six months	45.00	
By cash for Clerical Work	14.00	
By cash for Secretary's Expenses	73.26	
By cash for Special Agent, Trunk Line Association	11.00	
By cash for Insignia and Buttons	96.50	
By cash for Incidentals	.71	443.06
Balance in hands of Treasurer		$3,229.79

Respectfully submitted,

H. A. ARNOLD,
Treasurer.

II. REPORT OF THE SECRETARY.

The Secretary has the honor to report as follows:

ON MEMBERSHIP.

At the Kansas City meeting of the Association there were elected: Active members, 18; associate members, 7; corresponding members, 6, and honorary members, 5. One life membership was taken out.

April 15, 1900, there were elected 13 active and 3 associate members.

At the meeting of the Executive Committee, May 30, there were elected 21 active and 5 associate members.

Our membership to-day is made up as follows:

Active Members	456
Associate Members	38
Corresponding Members	25
Honorary Members	25

These figures show a gain of 44 over the number reported by my predecessor.

Since the meeting of last year our list has lost three names by death:

Surgeon Charles A. Siegfried, Lieutenant U. S. Navy.
Major Samuel Q. Robinson, Surgeon U. S. Army, and
Major Francis C. Armstrong, Surgeon N. G., Kansas.

The work of the Secretary's office has been much embarrassed for various reasons.

First, on account of the imperfect stenographic report of the proceedings of the Kansas City meeting. This necessitated much correspondence and consequent delay, resulting in a meager but, so far as it goes, a correct report for the Transactions.

Second, by the delay in transmission of the stenographic report and other papers to the Secretary.

Third, by the delay on the part of authors of papers in transmission of their manuscripts to the Publication Committee.

The Secretary would suggest that, in order to facilitate the preparation of the Transactions of the Association, for presentation to the Publication Committee, a rule be made that no paper shall be accepted for publication unless such paper be in the possession of the Literary Committee at the close of the meeting.

If such a rule be made there is no reason why the volumes of Transactions should not be in the hands of the members within four months after the meeting.

Respectfully submitted. CHARLES ADAMS, Secretary.

III. REPORT OF THE AUDITING COMMITTEE.

The committee appointed to audit the accounts of the Treasurer has examined the accounts and vouchers and finds them correct, and it is the opinion of the Auditing Committee that the thanks of the Association should be tendered to Lieut. H. A. Arnold for the admirable method in which he has conducted the business of the Association.

(Signed) JAMES TAGGART PRIESTLEY,
LEONARD B. ALMY,
THOMAS C. CLARK,
Committee.

IV. REPORT OF THE EXECUTIVE COMMITTEE.

The Executive Committee has to report the election, since the last meeting of the Association, of 34 active and 8 associate members.

The committee recommends, in consideration of their long and active service in the Association, that Commodore A. L. Gihon, Medical Director U. S. N. (Ret.) ; Brigadier-General F. W. Byers, Surgeon-General N. G., Wis. (Ret.), and Major W. H. Egle, Surgeon N. G., Pa., be transferred from active to honorary membership. It takes pleasure, also, in recommending Rear Admiral W. K. Van Reypen, Surgeon-General U. S. Navy, for honorary membership.

The committee recommends an amendment to Article IV of the By-Laws as follows:

No one, formerly a member of the Association, who shall have allowed his membership to lapse by non-payment of dues, shall be reinstated before paying all arrears.

At the last meeting Major T. C. Clark, N. G., Minn., proposed an amendment to Section 2, Article, II, as follows: Omit the word " and " in the second line, and after the word " states " in the third line insert the words " of the United States Volunteers and Acting Assistant or Contract Surgeons of the United States Army."

CHARLES ADAMS, Secretary.

V. REPORT OF PUBLICATION COMMITTEE.

The Publication Committee reports that, owing to delays in transmission of papers, the imperfect condition of the reports of the last meeting and the immense amount of time consumed

in establishing order in the papers of the Association, it has been impossible to hasten the publication of the Transactions.

As soon as practicable after the Kansas City meeting bids were invited from five responsible publishing houses and after conference with the President and Treasurer that of the Berlin Printing Co. of Columbus, Ohio, was accepted and the copy for the Transactions placed in its hands for publication. Work has been hurried as much as possible and the volume will probably be out within the next thirty days.

The committee wishes to say that it has been obliged to reject one paper on account of contained personalities, which the author after repeated request by the committee failed to eliminate, one paper as being without the province of military surgery, one for incompleteness, and one has been laid over to wait for illustrations upon which the value of the paper absolutely depended.

The work of the Publication Committee would be greatly facilitated if papers were more carefully prepared and more promptly placed in the hands of the Literary Committee.

CHARLES ADAMS, Chairman.
GEO. W. ADAIR.
S. C. STANTON.

VI. REPORT OF THE COMMITTEE ON NECROLOGY.

The Committee on Necrology reports that since the last meeting three of our members have been taken from us by death.

Francis Caldo Armstrong, Major and Surgeon, N. G., Kan.
Samuel Quincy Robinson, Major and Surgeon, U. S. Army.
Charles A. Siegfried, Commander and Medical Inspector, U. S. Navy.

SAMUEL QUINCY ROBINSON, MAJOR AND SURGEON, U. S. ARMY.

Samuel Q. Robinson was born in Boston, Mass., January 29, 1854. His father, George I. Robinson, was a native of Gilmanton Iron Works, N. H.; his mother, Sarah Louise Smith, of Marblehead, Mass. Major Robinson came of Revolutionary stock, being the great-grandson of Captain Noah Robinson, of the Second New Hampshire Foot, while his great-grandfather on the maternal side served under Decatur in the Navy. He was educated in the public schools of his native city and in the Scientific Department of Dartmouth College, from which he was graduated in the class of 1872. He then entered the Medical School of

LIEUT. CHARLES A. SIEGFRIED,
Surgeon U. S. Navy. Died January 14, 1900.

Harvard University and received the degree of M. D. in June, 1876. During his course of study he had a year's experience in the service of the Marine Hospital at Chelsea, Mass. He was commissioned an assistant surgeon, with the rank of First Lieutenant, in the Army in January, 1877, and passed his first year of service at the Military Academy, West Point, N. Y. After four years of arduous field service in the Department of Dakota, he was promoted to the rank of Captain. From this time until 1895 he was stationed at various posts in the Departments of Colorado, Texas and the Platte, with the exception of two years, one of which was spent at Fort Hamilton, N. Y., and the other on duty as attending surgeon and examiner of recruits in Philadelphia, Pa. He was promoted to the grade of Surgeon, with the rank of Major, in May, 1896, while serving as post surgeon, Fort Reno, Okla. In April, 1898, he accompanied troops to Tampa, Fla., whence he sailed with the Tenth U. S. Infantry to Cuba. He was in the field during the active operations against the city of Santiago, and when the Fifth Army Corps embarked for the camp at Montauk Point, L. I., he was left in charge of the Divisional Hospital No. 1, at Siboney, Cuba. Subsequently he held important positions in the Department of Santiago, but as his health became enfeebled he returned to the United States in February, 1899. His health, however, did not improve. He died of hepatic disease, November 6, 1899, while under treatment at the General Hospital, Hot Springs, Arkansas, adding one more to the list of lives surrendered in the service of the country.

MEDICAL INSPECTOR CHARLES A. SIEGFRIED.

Charles A. Siegfried was born June 6, 1850, in Northampton County, in the State of Pennsylvania. After a preliminary education in the schools of his native place, he began the study of medicine, and graduated from the Jefferson Medical College in the year 1872, and later in his career took advanced courses in Berlin and at Johns Hopkins University.

He was appointed an Assistant Surgeon in the Navy, June 8, 1872, and saw service for three years on the U. S. S. Richmond in the West Indies and on the Pacific Station. He was promoted to the grade of Passed Assistant Surgeon in 1875, and was assigned to duty at the Naval Hospital, N. Y. He served successively on the Receiving Ship Wyoming, the Alert, on the Asiatic Station, on the James River ironclads, the Colorado and Saratoga, and in the Naval Hospital, New York. He was promoted to Surgeon in January, 1885, and served successively on the

Quinnebaug, New Hampshire and Richmond, and at the Naval Station, New London, Conn. In 1892 he was a delegate to the meeting of the American Medical Association at Detroit, Mich., and in 1893 to the Pan-American Medical Congress at Washington, D. C. In December, 1893, he was granted leave of absence, which he spent in Germany studying bacteriology. In 1894 he was ordered to report upon the proceedings of the Section on Military Medicine and Surgery of the Eleventh International Medical Congress, Rome, Italy, March 25-April 5, 1894. Besides being an active member of this Association, he was a member of the following societies and clubs: The New York Academy of Medicine, the Reform Club of New York, the Newport Medical Society, the Newport Sanitary Protective Society, the Newport Natural History Society, and Newport Reading Room, and was lecturer and consulting physician to the Newport Hospital and Training School for Nurses.

Then followed tours of duty on the Cincinnati, Texas, Columbia, Massachusetts, and at the Torpedo and Training Station, Newport, R. I. He was promoted to the grade of Medical Inspector May 7, 1898. In the years 1894, 1895 and 1896 he was assigned to the duty of delivering the yearly course of lectures on Naval Hygiene at the Naval War College, Newport, R. I. During the war with Spain, while attached to the Newport Naval Station, he was on special duty in charge of the fitting out of the hospital ship Bay State, sent out by the State of Massachusetts for the relief of the sick and wounded in the campaign. In October, 1898, he was in charge of the Naval Hospital, Newport, R. I., and at this latter duty, on January 14, 1900, met with his death from double pneumonia after an illness of but three days.

Although not fifty years of age when death overtook him, Dr. Siegfried's life was a full one. As we read the record of any officer who has been even a decade in the service, its many entries seem to tell of abundant activity, yet this is but the routine of duty which comes to all of us; they are duties required by regulation of the industrious and idle alike. It is in that field of labor, largely voluntary, requiring a generous enthusiasm, a great unselfishness, and a full appreciation of life's responsibilities, that one finds the motives of a character like Dr. Siegfried's. He most happily combined the Teutonic love for scientific inquiry with the American ideas of practicality, a disposition of mind which has marked the ablest names in our profession. Arriving with these qualities at a period of life contemporaneous with the building and commissioning of our new Navy, he devoted himself with all the ardor of his mind to the solution of the many sanitary problems then introduced. The reports of the Surgeon-

General's office bear ample testimony to his labors in this special field. The vital and primal subjects of light and ventilation on the floating steel homes of our seamen, their enlistment, clothing, diet, all claimed his careful thought. Especially he studied the impress of environment on shipboard, upon the ordinary clinical aspects of disease. In all the duties pertaining to the more purely military part, he found his chosen element, and no officer has done more to advance these subjects than he. Dr. Siegfried was an early advocate of improvement in the status of the Medical Department of the Navy. He dwelt upon the mortality to be expected in modern naval warfare, with foes in any degree equal. His statistics on this point are probably the most exact we have. His schemes for instruction in first aid, the transportation, disposition and care of the wounded are of the best. Illustrative of his versatility, we find him one day inventing a portable operating table, on the next engaged in some complex bacteriological inquiry. With such qualities, the officer's abilities attracted attention which involved extraordinary duties. He represented the Navy at meetings of scientific and medical bodies, at home and abroad. He reported on Hospital Ships, and his knowledge on this subject made his services very valuable in the late war.

This man's life in private was as admirable as was his public career; blessed with a fine physique and striking personality, his disposition was buoyant and elastic. His temperament was always positive, and he advocated his opinions with convincing force and earnestness, an element which contributed much toward his success. The abundant testimony in the daily press speaks eloquently of the man and deplores his loss. In the words of one who knew him best " He was in all the relations of life as near perfect as it is ever given man to be." Like Guyon of Marseilles, he died at his post, being engaged in the writing of a valuable paper to be read before the approaching Ninth International Congress of Hygiene and Demography, to be held at Paris, for which honorable service his abilities peculiarly fitted him. We cannot record the labors or portray the character of a subject like this in a few lines. Briefly we can say, Dr. Siegfried represented the highest type of the medical military officer and gentlemen. Cut down in the midst of vigorous physical and intellectual activity, the memory of his useful and noble life is left us as an example.

REPORT OF THE NOMINATING COMMITTEE.

The Nominating Committee begs leave to report as follows:

FOR PRESIDENT.

Brig.-Gen. Alex. J. Stone, N. G., Minn.,

VICE-PRESIDENT.

Med. Dir. John C. Wise, U. S. Navy,

SECOND VICE-PRESIDENT.

Brig.-Gen. J. Francis Calef, N. G., Conn.,

SECRETARY.

Lt.-Col. Charles Adams, I. N. G.,

TREASURER.

Lieut. Herbert A. Arnold, N. G., Pa.

The Association has been invited to hold its next meeting at St. Paul, Minn., and at San Francisco, Cal. These invitations are respectfully referred to the Association for its decision.

(Signed) G. H. HALBERSTADT, Secretary.

June 2, 1900.

THE ADDRESS OF THE PRESIDENT.

May 31, 1900.

It is a source of much congratulation that so many members of the Association are able to be present at this meeting. When it is considered that active operations are still going on in the Philippines, that Cuba and Porto Rico and other islands are occupied by our forces, thus necessarily keeping most of those members who belong to the U. S. Army and Navy and U. S. Volunteers from being present with us, and that the members from the Marine Hospital Service and National Guard and State Services are scattered all over this wide country, it is, as I have said, a source of congratulation that so many have gathered here. To most it means a sacrifice of much time and a large outlay. It is an evidence that the interest in the Association has not diminished and promises well for its future.

We are honored by the presence of a representative of the British Army, Colonel McWatters, R. A. M. C., the principal Medical Officer of Canada, from Halifax, Nova Scotia, and of the Republic of Mexico in the person of Major Narciso del Rio, of the Military Hospital of Vera Cruz. The Association appreciates very highly the generous action of the Governments referred to, and welcomes most cordially their representatives to our meeting.

I am happy to say that we shall have the pleasure of having with us before the meeting closes the distinguished head of the Medical Department of the Army, General Sternberg, and possibly the Supervising Surgeon-General of the Marine Hospital Service, General Wyman. It is a great pleasure to welcome him and members of his corps to active participation in our work.

The reports of the Secretary and Treasurer, just read, show that the affairs of the Association are in a highly satisfactory condition, due chiefly to the able management of these two officers. There has never been so large a cash balance on hand as at this meeting. Both the Secretary, Lt.-Col. Adams, and the Treasurer, Lieut. Arnold, have met with great difficulties from the absence of their predecessors, the former Secretary and Treasurer, on active service, and the consequent interruption and confusion in the records and accounts. Their success in bringing the affairs of their respective offices into good shape again merits our sincere thanks.

I am sure you will join me in extending our thanks, also, to the Literary Committee and especially to its Chairman, Surgeon-General Calef, of Connecticut, for the excellent literary program which has been prepared for us. The absence of many members from the country and the short time that has elapsed since the last meeting has much increased the work of the committee, but has not interfered with its success.

In organizing the work of the present meeting it has been the endeavor of the Literary Committee not only to secure papers on topics of timely interest to the members of the Association, but to make the discussion on the several topics presented a prominent feature of our proceedings. General Calef informs me that in furtherance of this plan he wrote to more than seventy-five members who were likely to be present and whom it was thought could add interest to the subjects to be discussed. Many of those addressed were unable to be present, but it is hoped that their places will be filled by others though their names have not been announced in the program. I hope the list of volunteer speakers will be a large one. Experience shows that the warmth of discussion often brings out interesting and valuable words from those who had not expected to speak.

In considering what topics I should take up in the address which it is customary for the presiding officer to lay before you, it seems to me I cannot do better than to briefly present some thoughts on the Association itself; to sketch what it has accomplished with some suggestions for the work it may yet do for Military Medical Science.

The Association is not so old, nine years, that the older members cannot easily recall its history. It had its birth, as we all know, in 1891, in Chicago. That distinguished Civil and Military Surgeon, whom we shall always honor, General Nicholas Senn, having already seen the advantages of such an organization in the Medical Department of his own State, first of Wisconsin and then of Illinois, determined to extend his efforts to a wider field. With the aid of kindred spirits, among whom I can name a few only, as Matthews of Illinois, Wheaton of St. Paul, Crane of Denver, Woodward of Michigan, Byers of Wisconsin, Chancellor and Griffith of Missouri, Carr of Ohio, Bryant and Henry of New York, Almy of Connecticut, Helm of Arizona, Burrell of Massachusetts, Egle of Pennsylvania, McGill of New Jersey, he founded the Association of Military Surgeons of the National Guard. At the initial meeting I had the privilege of being present on invitation of General Senn. Meetings were successively held in St. Louis, Chicago, Washington, Buffalo, Philadelphia, Columbus and Kansas City, the membership rapidly increasing

from 68, the number at the time of organization, to 459, noted in the Transactions of 1897. The Medical Officers of the National Medical Services had always been made most welcome at the meetings of the Association, and accorded a generous share in the proceedings, but in 1893 they were admitted to active membership and the Association then became the Association of Military Surgeons of the United States.

You well remember, I am sure, the notable address of General Senn at our second meeting in St. Louis, on the "Mission of the Association of Military Surgeons," in which he ably pointed out the direction in which the Association could best work for the advancement of medico-military science, and the improvements in the medical service that could be attained through its influence. It must rejoice the heart of our distinguished founder and first President to see how his counsel has been followed and how much has been accomplished by the Association which he has fostered. Each succeeding meeting has been marked not only by increase in membership and attendance, but in the increasing importance of the papers contributed. Each volume of Transactions has exceeded its predecessor in size and in the value of its contents until a store of medico-military knowledge has been accumulated nowhere else to be found. We will not say that the papers here brought together are superior to those found elsewhere, but they are of special importance and usefulness to us, as they embody the results of the study of our own problems worked out in a way to especially meet American conditions. The Transactions may well be called an Encyclopedia of Medico-Military Science, for every possible phase, almost, of the subject has from time to time been covered, and they have been discussed from the varying standpoints of the Military, Naval and National Guard Services. We find there articles on the enlistment, examination and care of recruits, on identification of the repeater; on the equipment, clothing, food and physical training of the soldier and sailor; on field, emergency and tropical rations; on the hygiene of camps and barracks and ships; on first aid to the wounded and battlefield surgery; elaborate articles and discussions on the various means of handling and transporting wounded afloat and ashore; on litters, ambulances, cycle carriers, hospital ships; plans for the organization of the Medical Department of Armies in peace and in active service in the field; careful studies and researches into the effects of modern weapons and missiles; on surgical diseases and operations, specially important for the military surgeon; on camp diseases and their prevention and treatment; on quarantine and disinfection; on nursing and military nurses, male and female, and the selection, training and equip-

ment of the hospital corps; on military and naval medical equipments for ordinary and for active service, with many ingenious suggestions for their improvement; on the construction and management of military hospitals; studies of the organization of foreign armies and their medical services, and the comparison of medico-military statistics. It is impossible to give in this summary way any adequate idea of the wealth of unique and important material to be found in the eight volumes of Transactions. Their value is recognized in foreign countries and many applications for them have come from abroad. The military authorities of the nation and states appreciate their value and increasing demands for them come from libraries throughout the country. Colonel Lippincott, the first Chief Surgeon in the Philippines, gives a personal illustration of the immediate practical value of our recorded work. When he was ordered, he told us at the Kansas City meeting, somewhat unexpectedly to sail from San Francisco as General Otis' Chief Surgeon, he took with him a complete file of the Transactions of the Association and employed his leisure on shipboard in their careful study. He was sure he could have taken no better way to fit himself for the serious problems that confronted him on landing, for the Army was exposed at once to the vicissitudes of battle and a campaign in a tropical climate.

But the benefits of the Association extend far beyond the influence of its Transactions. The meeting of Medico-Military men of National and State services at these gatherings, their personal contact and association, the discussion of topics of common interest and interchange of views have been of inestimable value in stimulating the development and improvement of the Medical Services throughout the country, both state and national. Year by year, more and more State Medical Departments have been organized and those existing have been improved, better equipped and more generally supported by the State authorities, and what is even of more importance still, the common study of subjects of common interest has drawn together the State Services and the National Services, in a way that cannot fail to be of great advantage to the Nation. This influence has been shown in the Spanish War of 1898.

Peace, we all know, is the time for study and preparation, and war for action and execution. It was inevitable, therefore, that our Association *as an Association,* should have suffered from the breaking out of hostilities, and the engagement of a large proportion of our members in active service. As an immediate effect it became necessary to omit our meeting in 1898. But the Association was then able to prove its value. Over 150 members of the Association, nearly one-half its active membership, were

selected, largely on account of their being members and their presumed interest in and study of Medico-Military Science, for commissions in the U. S. or Volunteer Services. No one can measure, but no one can doubt the value of the lessons in military surgery and hygiene and administration learned by these officers in the meetings and discussions of the Association. Often was the knowledge thus gained of immediate and practical use in the performance of what were to most of us new and unaccustomed duties.

Let us not be disheartened by the want of appreciation in some cases on the part of our fellow-citizens of the meritorious work of the Medical Department in the Spanish War. Contemporaneous criticism is rarely just. It is usually hasty and either unduly laudatory or unjustly condemnatory. It is impossible for the nearby observer to correctly judge of great events, to estimate the influence of attending circumstances and impediments, to see things in their true proportions, and to render the due meed of praise or blame to the actors therein.

But it has already become recognized that in the Spanish War the Medical Department did its duty faithfully, nobly, and that in spite of most untoward difficulties and obstacles; difficulties in the first place attendant upon the sudden breaking out of war and the hasty enlistment of troops; on lack of time for preparation of material; upon an insufficient number of Medical Officers and Hospital Corps; on defective and delayed transportation; on the difficulties of unaccustomed foreign service and unhealthy tropical climates—difficulties and hindrances that were met with incomparable patience, zeal and intelligence. That its efforts did not meet with all the success that could have been desired was due to causes beyond control, and which were inevitable. New and hastily levied troops always have been and always will be specially subject to typhoid fever and other infectious diseases. They bring them from their homes or state camps, and until they learn the lesson of discipline, which is a slow process for the free American citizen, they fail to carry out the sanitary regulations prescribed for them and inevitably fall victims to disease. Much will be accomplished in the future if the recommendation of General Sternberg, now before Congress, for the establishment in the various parts of the country of camping grounds ready for the reception of bodies of troops, grounds provided with an ample supply of pure water and a proper system of sewerage, is carried out. His other recommendation, for a Corps of trained Medical Officers larger than is needed for the Army on a peace basis, and the instruction of line officers in the elements of hygiene and camp sanitation, should not be lost

sight of. One feature of the work of the Medical Department deserves especial note. As General Sternberg showed in his "Sanitary Lessons of the War," while the death rate from typhoid fever rose more rapidly in the Spanish war than in the Civil War, as troops were more rapidly and in larger numbers put into the field, the fall of the death rate was as notably rapid as the rise. This sudden suppression of the disease can only be attributed to the rigorous and effective sanitary measures that were instituted. As has also been shown, the mortality from wounds and disease in the late war was lower than in any previous war, and owing to the use of antiseptic dressings and the practice of antiseptic surgery recoveries of the wounded without mutilating operations were much more common and septic complications almost unknown. After the first difficulties were overcome and organization and discipline had its effect, in no army have the sick and wounded been more tenderly cared for and more generously supplied.

The value of discipline and experience is illustrated by the satisfactory conditions in the Philippines. The troops sent there were for the most part not hastily raised levies. Time was given for preparation and discipline and training, and many of the officers had had experience in the United States, Cuba or Porto Rico. The reports that are received from those islands show both that the troops have withstood the diseases incident to the severe strain of the campaign in that tropical country beyond what was naturally to be expected, and that they have been well cared for in spite of the difficulties of administration in that distant country.

This review of what this Association has directly and indirectly accomplished is an indication of the work that lies before us, and I cannot do better than repeat some of the suggestions in General Senn's memorable presidential address already referred to.

In the first place, each member who has opportunity should make a careful study with original research if possible, of the problem he is interested in, and present the fruits of his labors for the instruction and discussion of his comrades. The discussion of Medico-Military topics at our meetings is almost as important as their presentation, since it is only by discussion and criticism that the views of others than the writer can be elicited and a broader treatment of the subject attained.

The interesting experiences of some of our members during the late Spanish war have by no means all been recorded. We ought to have more papers descriptive of them while the incidents are fresh in their minds. Many lessons useful to us as

military surgeons can be drawn from the events of 1898, lessons from which we can gather instruction, warning and encouragement.

Since the Association meets but once a year and interest in the subjects of our study is apt to languish in the interim, State Associations should be formed where they do not already exist and hold quarterly meetings. These meetings would in some degree serve the purpose of instruction of Medical Officers when more methodical and frequent teaching could not be carried out. When the number of Medical Officers is small, two or three contiguous States might unite in holding their gatherings as is sometimes the practice in civil Medical Associations.

In view of this lessened interest in our work from the infrequent meetings to which I have referred, the establishment of a Medico-Military magazine or journal, a subject that has already in the past been twice under consideration, is again being agitated, and I understand will be brought before this meeting. There is very much to be said in favor of such a movement. The interest of our members in Military Medicine would be undoubtedly better maintained by such a journal and there is an abundance of valuable and interesting material now finding its way into the civil journals which could be brought together in such a publication and thus be made more available for those specially interested in Military Medicine. It is claimed that such a journal could be made almost, if not quite, self-supporting by obtaining proper advertisements and that then the membership fee which is deemed excessive by some of those so situated that they cannot attend the meetings, could be diminished. Such a journal would give an opportunity not only for original articles, but for abtracts of papers in foreign journals, for reviews of Military Medical books and notices of improvements in apparatus and equipment as they appear.

Before any action is taken, however, the subject must necessarily be most carefully considered. Success largely depends upon the selection of the right man for Editor in Chief or Manager, one who combines editorial ability with energy and sound business judgment.

The importance of carefully selecting Medical Officers is apparent. The practice of examining candidates for State Medical Commissions, which has been extending, should become universal. Our utmost influence to bring this about should be exercised so that no one shall be appointed from purely social or political reasons. The consolidation of the Medical Officers into a corps under the immediate control and direction of the Surgeon General of the State would not interfere with suitable

regimental assignment but would conduce to better direction and instruction. The establishment of a Hospital Corps with due proportion of non-commissioned officers should be secured in every State, and its careful instruction provided for.

The establishment of a Military Medical School, advocated by General Senn in the address referred to, has been realized though not exactly on the lines indicated by him. The U. S. Army Medical School was established at Washington on the recommendation of General Sternberg, and the Department of Instruction for the Navy at Brooklyn Naval Hospital on that of Surgeon General Tryon, U. S. Navy, both in 1893. Both have been of great value to their respective services. Of the Army Medical School I am better able to speak, having had the honor of being the President of its Faculty. Twenty-four newly appointed Medical Officers have been graduated from that school and about an equal number of older Medical Officers have profited by the laboratory instruction. The influence of the school in increasing the efficiency of our Medical Officers has been marked, but, unfortunately, the small size of the U. S. A. Medical Corps, which is now no larger than under peace conditions, has made it impossible to spare any officers for instruction for the past two years.

The success of the Army Medical School cannot fail to make us hope that its benefit may in the not distant future be more widely extended and that all Medical Officers, National and State, may be specially trained before assuming the responsibilities of the Army Surgeon.

My experience as a member of this Association and somewhat favorable opportunities of observing legislative methods, lead me to believe that improvements in the Medical Service are to be brought about by our careful study of the problems and the wide dissemination of the results of our work rather than by direct influence of our Association as a body upon our national legislature. In the first place, it would be difficult always to determine what is best or what is practicable to accomplish under existing conditions, and, again, our lawmakers are little influenced by memorials or petitions. Much more can be accomplished by the personal influence of our members after discussion and conference among ourselves. The Spanish War has already had the effect of attracting attention to the need of our National Guard and the importance of a more intimate union between the U. S. and the State military forces. The present Congress will probably provide more liberally than before for the needs of the State military and further steps will probably soon be taken to unify the military resources of the Nation.

I have presented these brief remarks not with the intention of formulating any measures upon which you could act, but merely for your individual consideration. The honor you have done me of calling me to preside over your work is a very great one, but it has been bestowed on me more in appreciation of the interest I have taken in the Association from its organization and in its success and progress than from any merit on my part.

Believe me, this Association is an agency for inestimable good to our Nation, to our respective Services, and of profit to ourselves as Military Surgeons. Let us cherish it, work for it, endeavor to improve it, to make it still more effective. We are all, Medical Officers of the U. S. Army, Navy, Marine Hospital Service, Volunteers and National Guard, working for one common purpose. Did we lack a motto, we could well take that of the distinguished Society, whose hospitality we here enjoy, the New York Academy of Medicine—"*Una fides, altare commune.*"

I. WHAT SHOULD BE THE STANDARD OF VISION REQUIRED OF THE ENLISTED MAN IN THE ARMY OF THE UNITED STATES?

BY
MYLES STANDISH,
CAPTAIN COMMANDING THE AMBULANCE CORPS, M.V.M.

The standard of vision required in the physical examination of applicants for admission to West Point to be educated at the expense of the Government as officers of the United States Army is 15-XX in either eye without glasses and 20-XX with glasses.

The standard required in the physical examination of an applicant at Annapolis to be educated at the expense of the Government and subsequently to have charge of war ships of great value, is 20-XX in one eye and not less than 15-XX in the other without glasses. These men are examined upon the supposition that in all probability they will remain in the service until they are retired for age.

The standard of vision required for an applicant who desires to enlist as a private in the army of the United States is 20-XX in each eye without glasses. There is every probability that his service will not extend over more than two three years' enlistments. That such a standard is unnecessarily high would seem to be obvious from the mere statement of these facts.

Upon the opening of the Spanish War the newspapers were filled with articles and paragraphs commenting upon the number of men in the National Guard who were rejected by the United States examining officers for physical disability. The impression produced on the public mind was that the State troops were largely cripples and invalids. Now this high percentage of rejections was very largely due to the number of men who could not come up to the standard required of 20-XX vision in each eye —*each* being the important word.

In this connection, it is true where we have a small army for which many more men apply for enlistment than are required, we can afford to make our standard of vision higher than that maintained in the conscripted armies of Europe and which standards are by no means to be advocated under the conditions of our service, but, for the purpose of mere comparison, I propose to give the minimum standard required in the various armies of Europe for troops on active service:

First, it should be noted that in Continental Europe the enlisted soldier is permitted to wear glasses, which is not permitted in either the American or English armies, but that as a general rule myopia or hypermetropia of 6.00 D. or more, determined under a mydriatic, disqualifies for service.

The requirement of vision in the French Army, Regulations of 1894, which is at present in use, after correction of myopia, is ½ with both eyes together and not less than 1-10 in the poorer eye, and in Cavalry and Artillery normal vision in one eye and not less than half vision in the other.

In the Austrian Army, a man is qualified for service if he has 6-12 vision in each eye after correction of myopia if it is present.

In the Army of Holland the only standard of vision I could find was in the case of astigmatism in which if the vision was reduced to less than 1-5 in the right eye, the left being normal, or to less than 1-20 in the left eye, the right being normal, a recruit was rejected.

In Italy the Royal decree of September 26th, 1881, rules that reduction of vision to 1-3 of the normal in the right eye, or to 1-12 in the left eye, although vision in the right eye is up to normal, if caused by organic changes, or incurable disorders of the globe of the eye, a very important qualification, incapacitates for military service.

The latest Belgian regulations determine that reduction of vision in the right eye to 1-3 of normal causes exemption from service, although a reduction of vision below this limit in the left eye does not cause exemption.

The Swiss Army regulation for the minimum of vision for the Artillery is normal; for the Infantry is 3-5 and for all other troops 1-2. Wherever the vision in one eye is normal, vision in the other may be as low as 1-8, but these conditions do not allow men to be employed as riflemen unless the eye with normal vision is the right eye.

The rules in the Danish Army exclude from military service all men having vision below 1-5.

In the English service instead of test-types, the candidate for enlistment is required to count dots and describe their positions. The dots at present in use, which must be seen at a distance of 15 feet, require a vision of less than 1-3 normal.

Such standards as these which I have just given are, of course, too low to be considered by us in connection with enlistment in the United States Army, but nevertheless, the ideally exalted standard of 20-XX vision in each eye seems to me as an oculist absurdly high. I myself have seen in the camp at South

Framingham, Massachusetts, men who had obtained sharp-shooters' medals for accurate shooting under a system of strict supervision, rejected by the examining officers and green recruits who had never held a military rifle in their hands, enlisted in their places. Now these rejections did not mean that the man did not have 20-XX vision, or even more with his right eye, which he used in sighting his rifle; it only meant that through a refractive error or congenital amblyopia, he could not read 20-XX with the left eye. The question is, were these rejections justifiable? The man who has had 20-XX vision in his right eye and 20-XL vision in his left eye from childhood can use his eyes together with all the quickness and accuracy of another man who happens to have 20-XX vision in each eye. Indeed, it seems to be doubtful whether for the purpose of sighting a rifle, it is necessary to have 20-XX vision in either eye. The visual angle necessary for 20-XX vision with Snellen's optotypes would theoretically enable the soldier to see a man six feet in height at a distance of 1,375 yards, but as Longmore in his Optical Manual very sensibly states, "practically at such a distance, owing to the effect of the intervening atmospheric and other circumstances, the man could not be distinguished, although an object having the same visual angle might be plainly seen in a nearer position under adequate illumination."

It is true, of course, that atmospheric conditions in America are as a rule more favorable to accurate vision in the distance than is the case in Europe.

In this connection it is interesting to note the standard of vision that has been set up by Dr. Charles H. Williams in the eastern districts of the New York, New Haven and Hartford Railroad. Dr. Williams is a man who is not only an oculist of reputation, but who has had years of practical medical service on one of the great railway systems of the Continent. His tests require that engine-men, firemen, tower-men and draw-tenders on entering the service shall have 20-XX vision in each eye, but permit a man who has been in the service to continue in all these positions if he has 20-XXX vision with both eyes open; therefore, it would seem that in his estimation 20-XXX vision is amply sufficient to enable a man under American atmospheric conditions to see quickly and accurately, the requisition of 20-XX vision upon entering the service being put in because it is expected that these men are entering upon a life-long service and some allowance must be made for deterioration of vision as the years go by.

A standard of vision at enlistment which requires 20-XX vision in the right eye and 20-XL vision in the left eye would in my

opinion nowise hamper the service and in all probability a standard of vision which required 20-XXX vision in the right eye and 20-L vision in the left eye would be sufficiently high for all branches of the service except perhaps the Cavalry and Artillery.

But accuracy of vision is not the only qualification which should be looked for in examining recruits. There are several ocular diseases, which could be determined absolutely only by the use of the ophthalmoscope, that greatly impair the vision in a reduced light and individuals having this impaired vision would be of very little use on night duty and, therefore, it seems to me that the field of vision in each eye should be roughly taken, perhaps by the ability of the applicant to recognize movement of fingers in the periphery and also that all recruits should be tested as to their ability to read test cards in a reduced light. If the vision of such a recruit falls considerably below that of the examining officer, he should not be enlisted without ophthalmoscopic examination.

In conclusion, it is my opinion that a vision of 20-XX in the right eye and 20-XL in the left eye is more than sufficient for practical service and even if our standard were placed lower, the service would not suffer and many otherwise eligible men would not be rejected.

II. TO WHAT EXTENT SHOULD THE MILITARY SURGEON BE REQUIRED TO INVADE THE REALM OF OPHTHALMOLOGY?

BY

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Having for many years been impressed with the lack of interest manifested by military surgeons in the science of ophthalmology, even in its most practical aspects, and having become convinced that this indifference has worked to the serious disadvantage of the military service, I have determined to present, at this meeting of "The Association of Military Surgeons of the United States," a paper with the above title, as a plea for a more thorough understanding of this branch of medical science on the part of the medical officers of the services.

In order that I may avoid the imputation that, with an ophthalmologist's exaggerated opinion of the importance of his own line of practice, I am attempting to force my specialty upon the services, I shall state that, in addition to being an oculist, I am a general practitioner of many years experience, and that, besides performing the strictly medical work required of my position, I am accustomed to operate frequently upon non-strangulated hernia, appendicitis, and other surgical conditions, which go to make up the professional life of the general operating surgeon.

I trust, therefore, that the right will be accorded me to speak upon the practical ophthalmological points, which I shall bring forward in the following pages, from the standpoint of the general practitioner.

To return to my subject, the indifference concerning ophthalmological matters, previously referred to, is by no means confined to the military surgeon, for the general practitioner in civil life shows as little interest in this respect as does his military confrère. The civilian physician, however, can afford to give ophthalmological study a wide berth for the reason that almost universally he finds at his elbow the skilled oculist, to whom he can refer his eye-patients as soon as he feels the need of the services of the specialist, thus relieving himself of professional responsibility and promoting the ocular interests of his patient at the same time.

No such harbor of refuge from grave professional responsibility is, as a rule, within reach of the military surgeon, serving, as he must do, on board ship, or in remote localities, both at home and in our foreign possessions, where he must rely upon his own resources reinforced, possibly, by the counsel of his confrères no more skilled in ophthalmological matters than himself.

Now, let us look into the practical side of this question, always bearing in mind that we are discussing strictly military ophthalmology in its every day phases, and that, too, from the standpoint of the general practitioner.

I. The military surgeon should understand the general principles of refraction, meaning by this statement, that he should know what ocular conditions constitute hypermetropia (far sight), myopia (near sight), and the various types of astigmatism. He should be able, also, to make an approximate test for these refractive errors in order that he may prove their presence, or eliminate their existence as a source of doubt, in cases of defective vision in the personnel of his command. He should understand the action of the accommodation in masking, or partially overcoming, such conditions, and should realize the effect of increasing years upon this ocular function.

A knowledge of the action of lenses should be expected of him, a knowledge which any intelligent man, without advanced mathematical training, should be able to acquire in a very short while, with a minimum of intellectual effort. There are no abstruse mathematical calculations necessary, and no knowledge of higher mathematics is required for the acquirement of this information in the simple way here intended.

It must be distinctly understood that I am not advocating the untenable proposition that every military surgeon should be a skilled refractionist. I do maintain, however, that he should know something of elementary refraction, and have some idea of the use of lenses in the various conditions of ametropia. It may be asked with seeming pertinence, why should the military surgeon be called upon to pay attention to refractive conditions, when the vision tests at the time of the original entrance into the service, would, in requiring a naked-eye visual acuity of 20-20 each eye, exclude cases of troublesome refractive error. Such an opinion as that involved in this query is a fruitful source of error, for it may be stated most positively that a naked eye visual acuity of 20-20 in a young subject is not incompatible with an error of refraction likely to cause trouble in later life. The official standard will, it is true, exclude myopes and persons affected with myopic, or mixed astigmatism, if these forms of

ametropia be of other than trivial degree, so that those ametropes capable of reaching the standard must, as a rule, be limited to hypermetropes, and hypermetropic astigmatics of moderate degrees of error, and with good power of accommodation. The use of the accommodation is necessary in such cases in order that the refractive error may be temporarily overcome and the eye adapted to parallel rays.

It may readily be understood, therefore, that, in consequence of the constant and regular decline of the power of accommodation due to increasing years, a hypermetropic soldier, after two or three enlistments, may be unable to reach the required standard of vision, although as a young recruit, years before, he had found it possible to overcome his refractive error by positive accommodative effort, and thus comply with the visual requirements for enlistment. These are the men whom company commanders are anxious to get rid of when the target season unmasks their defective vision, and for whose discharge on surgeon's certificate of disability they urgently clamor. To discharge these men, or to refuse them re-enlistment on account of this type of visual defect, would be opposed to the interests of the Government, and would be an act of injustice, in addition, for in originally accepting them as recruits upon the attainment of a visual acuity of 20-20, the War Department stood committed to the acceptance of their latent refractive conditions as well. The act of debarring them from the service on account of an assumed visual disqualification, technically affecting them after enlistment, commits the Government in the matter of pensions, and at the same time causes the loss to the military establishment of trained soldiers *without reason.* I say *without reason,* for the seeming visual defects are perfectly correctible by lenses.

It seems preposterous that the names of men so affected should be placed upon the pension list when, if the medical officers of the services could make a practicable application of the rudimentary knowledge of refraction, referred to in the preceding pages, the Government would not only be spared this useless expense, but the services of these men would also be restored to their commands.

There is another condition liable to cause trouble and lead to the unnecessary discharge of soldiers, which can be unmasked by the application of the most elementary knowledge of refraction, and of the action of lenses.

I refer to paralysis of the accommodation following various infectious diseases.

This toxic paralysis is binocular, and the pupil may, or may not, be dilated. It is purely a temporary affection, and ultimately

the power of the accommodation will return. Furthermore, a rudimentary knowledge of the action of prismatic lenses will enable the medical officer to detect cases of feigned monocular blindness after other methods of examination have proved the non-existence of ocular disease. The importance of detecting such malingering needs no discussion in an assemblage of military surgeons.

II. It is a matter of great practical importance that military surgeons should acquire the ability to make a simple inspection of the fundus oculi and of the dioptric media with the ophthalmoscope.

It cannot be expected of them that they should become expert ophthalmoscopists, but they should, at least, be able to bring the optic disk into view, and to appreciate marked abnormal changes in the appearance of the nerve and retina. They should also possess the power of recognizing marked degenerative changes in the choroid, and should be able to detect opacities of the vitreous body, lens, and cornea. A very little practice with the ophthalmoscope will give this power of observation, and, when once acquired, the general practitioner will have gained a wonderful aid in diagnosis and prognosis, as well as a means of acquiring most valuable indications for treatment.

To the military surgeon, separated as he is from special counsel, the ophthalmoscope is simply an invaluable aid in his professional work.

Let us see, now, if there are any practical grounds for this assertion. I shall illustrate the value of the ophthalmoscope in the hands of the general practitioner by bringing forward the advantages to be derived from its use in the following common ocular conditions. 1st. In optic neuritis. Any tyro in the use of the ophthalmoscope who has ever seen a normal disk should be able to recognize an optic neuritis at sight. The military surgeon need not give himself any concern as to the special type of optic neuritis present in any given case, a distinction of interest to the specialist only. All that he need establish is the fact that the optic nerve is inflamed. The swollen disk, its marked increase in diameter, the whitish or grayish color, the fine hemorrhages on its surface, the loss of transparency, the disappearance of the central vessels, the enlargement and tortuosity of the retinal veins, as well as the diminution in size of the arteries, make such an unmistakable picture that any one, who has seen a plate in a text book representing an optic neuritis, should recognize the actual condition at a glance. Vision is diminished, as a rule, but at times it may be very slightly affected. Now, what is the practical importance of the existence of this affection that the general practitioner should

take the trouble to find it, or to demonstrate its absence, in any given case?

This disease is always a symptom of great moment, pointing generally to serious intra-cranial mischief such as a meningitis, an abscess, an effusion, a neoplasm, or other affection characterized by increase of pressure within the skull. A double optic neuritis is a most valuable symptom of the existence of a brain tumor, which may be a simple neoplasm, a malignant growth, or a gumma, being found in from seventy to ninety per cent. of such cases.

This symptom, added to even vague evidences of intra-cranial tumor such as dull headache, slight vertigo, and possibly nausea, makes the diagnosis almost absolutely positive. Besides enabling us to make a diagnosis of brain disease, the ophthalmoscope affords data for forming a very gloomy prognosis as to the visual power likely to remain in non-fatal cases of such disease accompanied by an optic neuritis, for the consecutive atrophy of the nerve may be expected to abolish useful vision, and probable blindness may be dreaded. For the reasons given, which every intelligent practitioner will appreciate, in every case of suspected brain disease the optic disk should be inspected with the ophthalmoscope as a routine measure, whether the vision be affected or not.

2d. In albuminuric retinitis. In this affection the appearances are so marked as to force themselves upon the attention of the most unskilled observer. The optic disk is swollen while its boundaries are blurred and obscured. White patches surround the disk blending frequently into one white glaring area, this appearance being due to fatty degeneration and sclerosis.

Small hemorrhages are seen scattered over the white area. In the neighborhood of the macula lutea linear white splotches, having a stellate arrangement around the fovea centralis, are frequently found.

These changes are due to fatty degeneration of connective tissue, sclerosis of nerve fibres and of the arterial walls, and edema.

Frequently these appearances coexist with vague general symptoms of Bright's disease, which do not forcibly impress themselves upon the patient's attention. He may consult the surgeon with reference to a possible failure of vision, when the use of the ophthalmoscope gives the clue to the trouble, the nature of which will be settled by the chemical and microscopical examination of the urine. This affection is primarily a sclerosis of the blood vessels due to long continued renal disease, and the

other lesions (hemorrhages, fatty degenerations, edema, etc.) are secondary.

When an albuminuric retinitis is discovered in a case of chronic renal disease, it is an indication that the end is not far away. The expectation of life may be placed at about one year, at most two years, from the beginning of the trouble. The prognosis is bad because the same vascular changes may be assumed to exist elsewhere, especially in the brain. In the albuminuric retinitis of pregnancy, the appearance of the retina and nerve is about the same as in ordinary Bright's disease. In such cases the medical officer should, without delay, empty the uterus, whether the child be viable or not, as a means of preserving the life and vision of the mother. Are not these ophthalmoscopic findings and their indications of the greatest practical importance to the military surgeon?

3d. In cases of retinal hemorrhage. Hemorrhage into the retina may be either into the nerve fibre layer, or in the deeper layers of the retina. As soon as the observer catches a glimpse of such an extravasation of blood he will be certain to recognize it for he could not possibly mistake it for anything else, in its recent state. There may be one or many blood red patches of different sizes, and in different portions of the fundus. They all mean one thing, namely, that a retinal blood vessel has given way at the site of the splotch.

The subjective symptom of importance is defective vision dependent in its character upon the location of the hemorrhage, or hemorrhages, as, of course, the function of that portion of the retina, into which the blood has been extravasated, is temporarily lost through pressure upon its highly specialized nervous mechanism. If a peripheral blood-vessel has yielded, central vision very probably remains normal; if the lesion has occurred at the macula lutea, central vision is affected, while peripheral vision may be intact.

Retinal hemorrhage, not an accompaniment of inflammatory changes in the fundus, may occur in the following conditions liable to affect soldiers, especially when serving in the tropics, namely, in anemia, in malarial affections, in atheroma, in diseases of the liver, spleen, and kidney, in diabetes, gout, hemophilia, and scurvy.

Sudden diminution of visual power in one, or both eyes, in the case of a soldier, anemic and reduced from the effects of some debilitating disease, should at once suggest retinal hemorrhage to the attending surgeon, and an immediate ophthalmoscopic examination should be made. Seeing the hemorrhage will fix the diagnosis, enable the surgeon to give a probable prognosis, and

furnish indications for treatment, all of which data will prove most valuable to the general practitioner, who otherwise would be groping in the dark.

Simple retinal hemorrhages in officers and soldiers of middle age have another important bearing. They are in many such cases due to disease of the walls of the retinal blood-vessels, which may be taken as an index of the condition of the vessels of the brain. In cases of retinal hemorrhage in those of middle age, therefore, we must be on our guard against the occurrence of similar lesions in the brain, and it is of great importance that the patient should be given proper warning, and advice as to his daily hygiene. It is useless in an assemblage of military surgeons to urge the importance of detecting the cause of any sudden loss, or diminution, of vision among members of the military establishment, as in the case of visual defect due to hemorrhage in the retina, for it can be readily understood that by such detection useless discharge on surgeon's certificate of disability may, in many cases, be prevented.

4th. The use of the ophthalmoscope is of great value in the diagnosis of acute glaucoma after the acute symptoms have subsided sufficiently to permit a view of the fundus, when the characteristic cupping of the optic disk around its entire circumference, the enlarged tortuous and beady looking veins, and the arterial pulse, make a most positive picture.

In simple chronic glaucoma the media are clear, and the character of the disease can be at once detected by the ophthalmoscope.

5th. In the case of opacities in the vitreous body and crystalline lens it is very easy to demonstrate their presence by means of the ophthalmoscope, and when discovered they afford a definite reason for the existence of defective vision. Fine dust-like opacities deep in the vitreous, which may be so thick as to markedly befog the retina, are highly suggestive of syphilis, and their presence, if coupled with loss of transparency of the retina, and with the existence of white or yellowish spots of exudation surrounded by pigment in the periphery of the fundus beneath the retinal vessels, enables us to make an almost positive diagnosis.

In such cases, even though other evidences of syphilis are absent, most vigorous specific treatment must be instituted and persisted in, as, otherwise, the prognosis as regards the preservation of useful vision is very gloomy.

6th. Opacities of the cornea, which should be looked for in cases of defective vision, are best brought into view by oblique illumination, concentrating the light of a lamp, or gas flame,

upon the cornea by means of a strong convex lens, and causing the light to play over its surface. The ophthalmoscope will also be of assistance in this examination.

III. The military surgeon should possess sufficient ophthalmological knowledge to diagnose and treat urgent cases demanding immediate medical or surgical attention. The eye, too, has its "imperative surgery," and the military surgeon should possess the skill either to perform the operations indicated in such conditions, or to use palliative measures until the services of one more skilled than he may be secured.

Practically speaking, the following are the urgent ocular diseases and conditions which are liable to affect soldiers, and which will demand immediate attention at the hands of the military surgeon, namely: Iritis, especially of specific origin; acute glaucoma; gonorrheal ophthalmia; ulcers and abscesses of the cornea, with, or without, pus in the anterior chamber (hypopyon); foreign bodies in the cornea; wounds of the eye-ball, with, or without, the lodgment of foreign bodies in the interior; panophthalmitis; and sympathetic irritation, affecting the sound eye, as a result of injury to the fellow organ. In all of these conditions disastrous results may follow delay and improper treatment. The scope of this paper does not justify a systematic discussion of the diagnosis and treatment of the ocular affections enumerated, which information may be easily gained from any of the excellent text books now in print, but my paper would be most incomplete did I fail to mention a few essential points connected with the treatment of certain of them—points with which every military surgeon should familiarize himself. (a) Iritis occurring in soldiers is in the immense majority of cases a manifestation of specific trouble. So constantly is this the case that, when one eye is found affected with iritis in military practice, specific treatment should be at once instituted, and persisted in, in the hope of protecting the eye still unaffected, as well as with the intention of benefiting the diseased eye. This affection gives valuable warning of constitutional syphilis, and the specific treatment, instituted upon this indication, will be of great advantage to the patient in preventing other manifestations of the disease even more serious than the iritis. In addition to specific treatment and other measures usually adopted, such as functional rest, protection of both eyes from light, and warm applications, it is of vital importance that atropine solution should be instilled early and unsparingly throughout the affection. This is necessary in order that the mydriatic effect of the drug may draw the pupil away from the capsule of the lens, and thus prevent extensive adhesion of the iris to the lens capsule with possible occlusion

of the pupil, and closure of the communication between the anterior and posterior chambers. Without the use of atropine the eye will be seriously damaged, and useful vision possibly destroyed. That military surgeons do not always diagnose a case of iritis the following instance will prove. A few years ago upon reporting for duty at a large military post I found a soldier in the hospital suffering from a double syphilitic iritis, whose affection had been diagnosed as glaucoma, and who had been treated with instillations of the myotic drug eserine, instead of with the mydriatic atropine. The pupil in each eye was very small, and firmly attached to the lens throughout the greater portion of its circumference, the lens capsule in the area of the pupil being clouded, and vision highly defective. In fact, both eyes were ruined. A very little practical knowledge with early use of proper treatment would have preserved useful vision in this case. (b) It would seem that the classical symptoms of acute glaucoma, namely, pain in the head, with possible nausea and vomiting, swollen lids, injected conjunctiva, steamy and anesthetic cornea, shallowness of the anterior chamber, dilated and fixed pupil, turbid aqueous humor, discolored iris, impaired vision, and highly increased tension of the globe, would enable any intelligent physician to immediately diagnose this most dangerous disease. Such is not the case, however, and many mistakes are constantly made by general practitioners with reference to this affection with consequent loss of most valuable time. Some cases are of such fulminant character that vision may be lost in the first attack, though this unfortunate result is not usual. As a rule, in cases not properly treated one attack generally follows another until absolute glaucoma with hopeless blindness results. Both eyes are generally attacked, though with an interval varying from a few hours to several weeks. The prime indication in the treatment of a case of acute glaucoma is to relieve the high intra-ocular tension at once, and if the military surgeon, into whose hands such a case falls, should be unable to perform the broad iridectomy indicated, he must make use of some temporary means of reducing the tension until more skilled assistance may be available. How can this be done? A simple paracentesis of the anterior chamber made with a cataract needle, or the point of a tenotome in lieu of any special instrument, will by permitting the escape of the aqueous humor temporarily markedly reduce the tension. This should invariably be done if the indicated iridectomy is beyond the skill of the attending surgeon, and should be followed by instillations of eserine solution (.030-30 c. c.) or pilocarpin solution (about .130-30 c. c.) four or five times a day. If the tension again rises, a second paracentesis

should be performed, with a continuation of the myotic. This paracentesis is of purely temporary value, since as soon as the little wound in the cornea heals the tension will again rise. It is a very valuable expedient, however, to keep down the process until the patient can be sent to a military hospital where a surgeon able to perform the required iridectomy may be found.

To perform a paracentesis of the cornea is a most simple matter, and any medical officer, worthy of holding a commission in the service, should be capable of doing it.

(c) Ulcers of the cornea will require careful attention, but, as the general method of treatment is discussed thoroughly in the textbooks, it is not necessary to dwell upon it here. When, however, in spite of the usual treatment the ulcer continues to spread, some operative treatment will be required. It should be thoroughly curetted with a sharp spoon so as to remove all the sloughing tissue, in which are located the offending micro-organisms, thoroughly irrigated with a solution of boric acid, iodoform dusted upon the surface, and a pressure bandage applied. In case this fails to destroy the disease process, the ulcer may be touched with carbolic acid (pure) on the end of a probe, care being taken to make the application exactly at the point of ulceration. The actual cautery may also be used for this purpose and an awl, large needle, or probe, may be heated and used for this purpose in lieu of more complicated apparatus.

If the ulcer seems about to perforate and its floor bulges forward, a paracentesis of the cornea is indicated to reduce the intra-ocular pressure, and eserine or atropine instillations used as the ulcer is respectively peripheral, or central, in location.

An abcess of the cornea is a focus of suppuration within the body of the cornea, the pyogenic organisms having gained an entrance through an abrasion of the epithelium. The anterior wall of the abcess should be incised, and the infected area treated as an abcess. Pus in the anterior chamber (hypopyon) should be treated by making a broad paracentesis of the cornea at its lower margin, and attempting to secure an evacuation of the pus. It is needless to say that in treating abscesses and ulcers of the cornea strict antiseptic methods must be followed.

(d) Foreign bodies in the cornea should invariably be removed, as they are far from being innocuous and may lead to abscess formation. Their removal is easy under local anesthesia.

(e) In wounds of the eye-ball with lodgment of foreign bodies in the interior, back of the posterior chamber, the invariable rule in military surgery should be immediate removal of the eye by enucleation. In the case of penetrating wounds of

the globe in the region indicated without lodgment of a foreign body and without much loss of vitreous humor, as in small incised or punctured wounds, an effort should be made to save the eye by the use of antiseptics and a sterilized pressure bandage. If, however, symptoms of pyogenic infection make their appearance and panophthalmitis seems imminent, it is worse than useless to temporize, and the eye-ball should be removed at once. The removal of the globe after the thorough development of panophthalmitis is not considered entirely free from danger, as suppurative meningitis has resulted in some cases, being due, it is supposed, to the laying open of the lymphatic spaces of the optic nerve by its section, a channel for the spread of infection into the cranial cavity being thus furnished. If panophthalmitis has already developed in a case of wound of the eye-ball when the military surgeon assumes charge of the case, it is best, in the great majority of cases occurring in military practice, to treat the affection as any other abscess. A free exit for the pus should be made in the anterior division of the sclera, where when left to itself the abscess has a tendency to perforate and empty itself. When the abscess is drained pain will cease, and the eye-ball will soften and gradually undergo atrophy. No treatment, other than surgical, has any effect upon a panophthalmitis; when it occurs the eye is doomed, and the patient will have weeks of useless and most agonizing suffering unless the surgeon cuts short the process either by enucleation, which is generally considered dangerous, or by a free incision as indicated. If a small foreign body, as a splinter of any kind, should have entered the eye through the cornea, and should be seen loose in the anterior chamber, or be discovered entangled in the iris, the eye-ball should not be sacrificed. In such cases an attempt should be made to remove the offending body by making a broad paracentesis of the cornea with the lance-shaped keratome, and extracting it through the corneal incision with iris forceps in the first instance, or drawing out and excising the portion of iris containing it in the second.

(f) In all cases in which a seriously injured eye has been treated conservatively the military surgeon should be on his guard against the occurrence of sympathetic trouble in the sound organ. If the latter should become irritable, the injured eye should be removed at once, even though not entirely blind, else the sympathetic *irritation* will be almost sure to develop into sympathetic *inflammation* with loss of vision. There should be no hesitation on the part of the military surgeon in the treatment of such cases, and it should be an axiom in military practice that

the offending eye must be removed without delay upon the appearance of sympathetic irritation in the sound organ.

The answer to the question embraced in the title of this paper may be condensed into the three following propositions:

1st. The military surgeon should understand the elementary principles of refraction, and should know something concerning the action of lenses, and their uses in correcting refractive errors.

2d. He should be competent to make an inspection of the fundus oculi and dioptric media with the ophthalmoscope, and should be able to detect any striking change from normal appearances.

3d. He should possess sufficient knowledge to recognize dangerous ocular conditions demanding immediate attention, and should acquire the small amount of skill necessary to remedy, or palliate, such affections by surgical measures when indicated.

In conclusion, I would recommend at least in so far as the Medical Department of the Army is concerned, the following general plan for enabling the young medical officer to acquire the necessary information on ophthalmological matters as outlined in this paper.

When the Army Medical School begins anew its valuable work, which was of necessity discontinued at the outbreak of the War with Spain, a practical course in military ophthalmology might, with great advantage, be given the newly appointed assistant surgeons constituting the class. They could easily be taught the elementary principles of refraction, the use of lenses, and practical ophthalmoscopy. It is very likely that a small clinic from the poor of Washington City might be instituted for the practical application of the principles taught.

The various surgical operations for the ocular conditions, which might justly be classed under the heading "imperative," might be performed by the members of the class upon the cadaver until perfectly understood by all.

I would recommend, further, that after the establishment of such a course at the Army Medical School, a knowledge of the ophthalmological subjects included in this course be required at the first examination for promotion.

DISCUSSION ON PAPERS OF CAPTAIN STANDISH AND MAJOR BANISTER.

Major Eduard Boeckmann, U. S. V. (Ret.)—I am not a specialist on ophthalmology, although I admit that if there be a specialty it is ophthalmology. I am a general practitioner and know little of that specialty. Regarding the first paper read, there is so much material from which to draw our recruits, that from a practical point of view I do not see why our military authorities should differ from those in other countries where the material is not so abundant. I see no injustice done to the soldiers by the requirements of our visual standard as there are plenty of soldiers. I am in favor of having this country maintain as a standard for admission into the army, a vision of 20-20 in each eye.

Major Banister has shown a good deal of knowledge of ophthalmology and he will admit that the use of the ophthalmoscope is a life study. In surgery you will often remove tumors or other pathologic products, take them in your hands, inspect them and still you do not know what they are until you are told by some skilful person, who is thoroughly versed in the use of the microscope. So with the ophthalmoscope, it is easy to see but difficult to understand.

The most important use of the ophthalmoscope is for the purpose of illumination—for the purpose of diagnosing the different diseases of the eye. With reference to the use of atropine in certain cases, I want to put myself on record as an ophthalmologist who has absolutely no use for atropine. Using it for occlusion of the pupil, is, I think, entirely contra-indicated. I have seen case after case treated by the best ophthalmologists in Europe without any success. Furthermore, I want to place myself on record as one who treats iritis with eserine. I use it all the time. Atropine in acute iritis aggravates the suffering of the patient, increases the tension, and in teaching my students at the University I invariably impress them with this fact. I have always told them never to use atropine as is it a much overestimated and positively contra-indicated drug.

Major W. F. Southard, Cal.—The paper by Capt. Standish is so well written and to the point that it alone would be an intestering subject for discussion. Judging from my experience in examining the eyes of students and others, I am of the opinion that there is a tendency to lessen the standard, which would be bad precedent if used by the army, for the reason that we have

an abundance of material from which to draw our soldiers. It is also applicable to railroad employes whose eyes must be keen and perfect. It seems to me that it would be a rather unwise proceeding to admit into our ranks a man with a perfectly good right eye and a poor left eye. A sudden injury to the right eye might prove very disastrous, especially in the case of an engineer.

The examinations in the army are not conducted under the most approved method. We ought to have a uniform light, either artificial or daylight, depending on circumstances. In the City of New York and in Boston I presume that artificial illumination is necessary. In California the light is so uniformly clear and bright that I can use the daylight for the preliminary studies. For the military the two eyes should have a visual acuity of 20-30 for the reason of the vast amount of material at hand. There is no necessity for lowering the standard, but I do believe that a certain amount of judgment is needed. A man who has been in service for several years, one who has done good work, as in shooting, should not be excluded for any slight visual defect. I have seen men make three centers at 500 yards with three shots and they had only 20-40 vision. The standard of 20-20 is not too high in a new examination but in the case of old soldiers that should not apply. Examination of the field is very important. In the past year my assistant and I took from five to six fields a day and we incidentally found a very large number showing contracted visual fields without any pathologic condition of the fundus. I have three cases which I have recorded and of which diagrams have been made and printed where there is a visual acuteness of 20-16 and a large contraction of the field without any pathologic changes in the retina.

The excellent paper on the diseases which interest the general practitioner is worthy of being read and studied by every general practitioner in this country. That which applies to the military surgeon applies to the general practitioner, but I am afraid that we will not be able to obtain that knowledge of ophthalmology, which is desired by the writer, for many years to come unless we have special conditions under which we can study these cases. An extensive practice in a large clinic has taught me that there is always something new to be seen and that there are times when we see conditions which at first sight we would not be inclined to say were so and so when on second thought we feel that we can.

I disagree with Col. Boeckmann on the subject of iritis and the use of atropine and I am sorry to disagree with so learned

a gentleman. Atropine to my mind is the greatest drug that is used in iritis. In my limited experience of from 2 to 5 cases a week, I have within the last months seen 8 cases which have not been determined as iritis, but there were those little signs which had been misinterpreted. The patient had but the slightest involvement of the ciliary region and I discovered three or four adhesions. I used 8 grains of atropine to the ounce of distilled water every five minutes for half an hour. Then I put on hot applications and made the patient rest for two or three days. Some of you may think that that is wrong, but if I had used eserine or nothing at all, we would have had complete adhesions formed around the entire capsule of the lens. I see so many of these cases but my remedy invariably is atropine. I have seen cases in soldiers where the use of the atropine had been delayed for 24 hours and then there were extensive adhesions.

I maintain that our sheet anchor in iritis is atropine. We can use heat or anything we please, but it is imperative that we make every effort to keep the pupil away from the lens as the great danger, one much to be feared, is the formation of adhesions and the subsequent destruction of the sight of the affected eye.

Col. Wm. J. Maybury, Maine.—Permit me to extend to the literary committee my sincere thanks for this mark of courtesy. At the same time I freely admit, though with mingling feelings of regret, my utter inability to do justice to a subject of such vital importance. It has been with more than usual interest that I have listened to the most excellent papers and have received much food for thought therefrom. My term of service as Surgeon General on the staff of the Governor of Maine has covered the period during which the Americo-Spanish War existed. I can therefore only speak from the standpoint of the National Guard. My troubles began with the call to arms, for all that had been done during previous years had to be done over again, to avoid which in the future troubles of our country I have since issued positive orders for the examination of all recruits for the National Guard to be based upon the rules governing the examination of recruits of the regular Army. This, then, in a very few words, and not to go into elaborate particulars, is my idea of the subject, for not to do so causes not only a re-selection of able bodied men when called into active service, but produces a vast amount of disappointment and regret among those who have been admitted as members of our citizen soldiery, and who are perhaps filled with the fires of patriotism and devotion,

but are deprived of the opportunity to display it when they most desire to. The standard which may be adopted by the United States authorities cannot be too high for the National Guard, for if our Army can be speedily recruited to form an army as large as that of any nation on earth, so then can the state militia. The excuse that many men will be debarred from the companionable association with their fellow townsmen at weekly drills and annual encampment is trivial, and is in itself a strong argument for the insistence upon more rigid regulations. A well, athletic man will take pride in his development and whatever of amusement there may be in the carrying of a musket as an amateur, or later on as a professional, should be considered as secondary to the demands of actual war.

In a country like our own, which does not approve of the policy of supporting a large standing army, and especially since we have taken upon ourselves the responsibility of out-lying dependencies which may plunge us into warlike difficulties with other powers very suddenly, the health of the future soldier should become a study from his school-boy days, he should be given to understand the importance of physical perfection, and his admission to the National Guard made a guarantee of such a condition, as it will be a badge that any man will be proud to bear.

Any state having one of its regiments accepted by the National Government intact as organized should feel proud of its achievement, and such should be the possibility, not only for one regiment but for all. This and subsequent examinations after enlistment would keep the militia permanently up to the standard.

Major N. Darrell Harvey, R. I. M.—These papers have been so thoroughly and ably discussed that I have little to add. There are some points, however, which I will emphasize. I heartily agree with the sentiments of Capt. Standish's paper. I think the standards now exacted in the United States Army in regard to the eyesight of the soldier are too high, particularly for the left eye. Fields of vision should be taken rationally and the conditions under which examinations are made should be uniform. Those of us who had the opportunity of enlisting men from the State troops found that in many instances many desirable men were thrown out because their vision did not attain the required standard in each eye. In several instances I remember men from the National Guard who had been crack marksmen, men who were willing to serve their country, who were turned out for deficient sight in the left eye, the right being

good. The officers and the men were considerably disgruntled and the medical officers, particularly the ophthalmologist, had the brunt of the burden to bear.

Major Banister's paper is a very able dissertation and I hope his ideals can be accomplished. I have my doubts, however, whether the army surgeon can acquire the ability to diagnose the diseases spoken of, except by long and special training. Every general practitioner should understand the external diseases of the eye and he should be familiar with oblique illumination and in the estimation of refraction. The use of the retinoscope is easily acquired, in which some of the ophthalmologists present may not agree. Every army surgeon should be familiar with the use of the retinoscope in diagnosing the refractive errors of the eye. He need not distinguish one-fourth deviation, but with a widely dilated pupil he should be able to tell a high degree of myopia with a corresponding amount of astigmatism, which at the age of 40 would mean a depreciation of the sight.

I do not think that any ophthalmologist present will agree with Col. Boeckmann. I agree most heartily with Major Southard that the first step in the treatment of iritis should be the use of atropine. If the tension is raised myotics may be used but even then I have my doubts.

Major Boeckmann—The difference between the gentlemen who have spoken and myself is that they are ophthalmologists proper and I am not. They may be excellent ophthalmologists but I do not think that they are excellent pathologists.

Capt. Standish (closing the discussion.)—There seems to be some misapprehension as to what I said. I did not advocate anything less than 20-20 vision in the United States Army. A man with 20-20 in the right eye and 20-40 in the left eye has every bit as good vision, if it has always been so, as a man with perfectly normal eyes. The man's vision is good for every purpose for which he uses his eyes. I say that the present standard is like saying that we would not take a man who is not of a certain height, weight, circumference, etc. We do not expect to get ideal men, but only such as are within working limits of the ideal. It is an absurdity to expect the ideal.

Regarding the use of atropine, every ophthalmologist knows that if he gets total synechia in a case of iritis it never comes from nothing. It may be followed by a separating iritis but not by a return to the normal. As to the mechanics of the treatment, suppose the iris to be exuding exudative matter two or three times its thickness. It cannot exude that matter unless you draw it away from the lens. If I was teaching I should

require that every man should be able to diagnose an iritis from a glaucoma and any man who put eserine into the eye for iritis and atropine for glaucoma would not be graduated. I believe I would be justified. We see the failures from all over coming into the Massachusetts Infirmary and we see many deformities following bad treatment. Some of the previous speaker's students may have been some of the malefactors.

III. THE HYGIENE OF CAMPS OF INSTRUCTION.

BY

MAJOR JULIAN LA PIERRE,

SURGEON (RETIRED) C. N. G.

If we are to profit by experiences in the past and anticipate possible necessities that may lie before us in the future, then the time has arrived when, for the general welfare of the Nation, there should be some practical preconcerted action taken towards the establishment in every state of our Union, of a camp for military instruction.

There was never a more logical axiom sounded than, "In time of peace prepare for war," or a more practical illustration of the magnitude and importance of such preparation than exhibited in the late Spanish-American hostilities. What may be said to be true regarding the individual, may also be said to be comparatively true regarding the multitude, and no aspirant for fistic honors would ever receive the national support to enter the arena, no matter the amount of bone and brawn, if untutored, he was to encounter combat at the hands of weeks and months of hygienic preparation.

Camps of instruction are already established in many of the states and their locations from a hygienic standpoint are presumed to be fair, and their sanitary provisions efficient, as long as they are occupied by only one to three thousand men for periods of from five to ten days, during that part of the year when climatic conditions are supposed or expected to be most conducive to the health and comfort of out-door life. But how would it be if more prolonged and condensed occupation was forced upon them during those inclement periods that go to make each year complete?

Even now the annual week's vacation, that is looked forward to each recurring year with pleasurable anticipation by recruits from shop and mill and store, is by far too often followed with regrets in the guise of stomach and bowel derangement or even enteric fever, while the peace at any price man, the economic tax-payer and the worthy church warden are all only too prone to attribute to poor whiskey and ice water all the ills that flesh is heir to. A few days have sufficed to transform the green sward and fresh parade into a brown desert, unsanitary in aspect, unhygienic in reality, until the storms of

autumn, the snows of winter and the sunshine of another spring and summer shall remove or purify each and every atom of contamination. And what is to be the remedy? At the seventh annual meeting of our Association held at Columbus, Ohio, 1897, special committees were appointed, looking forward to securing a uniformity of organization and outfit in the Medical Departments of the several states.

The disturbing influence of our hostilities with Spain made it impracticable for our Association to convene in 1898, and so to that, and that alone, I presume, may be attributed the failure of a commendable movement; a movement that could not have been indifferent to the hygienic improvement of Camps of Instruction.

It would be very interesting history, and instructive as well no doubt, if every member of our Association who took part in any way in the conduct of those hostilities, should make record of his personal experiences, with deductions drawn from the same, and conclusions arrived at, after summing up the sum total. Would the assets balance the liabilities? And with our growing ideas of expansion and self imposed duty of protection for every poor devil of a half-breed that happens to be born anywhere between Cape Horn and the mouth of the Yukon River, are not the liabilities with us to-day even in a greater degree than they were three years ago?

Few of us then thought at parting we should soon hear the bugle call and become familiar with its early morning notes. Surely there was experience enough from Chickamauga Park to Montauk Point to prove the one lesson at least, that it would be wisdom to prepare Camps of Instruction before their occupation, especially when to be occupied by unseasoned volunteers. To attain such desirable ends, it would seem more reasonable to the writer, that each of the several states should locate and equip at least one or more Camps of Instruction for its state forces. As in time of war, a republican form of government must largely augment its standing army, by calling at short notice a proportionate number of volunteers from each of the several states, the first hygienic step should be in establishing a uniformity in the physical and moral standard necessary to qualify the recruit.

No man should be tolerated in the National Guard who is not physically and morally eligible to wear the uniform of the regular army. That State is wasting time and money that authorizes the equipment and instruction of material that would be condemned by the regular army surgeon. The fixing of a uniform standard of physical and mental requirement would do more, in my opinion, than any other one act toward eliminating from the body

military, certain political proclivities that only tend to repel the true martial instinct and attract culpable cupidity, so palpably evidenced in the organization and preparation of bodies of men for National defense heretofore.

First have roomy and suitable sites for Camps of Instruction, located in each of the States where such are not already in existence. In our coast States these might be located contiguous to tide waters, for the oceanic breezes have a remarkable influence in counteracting the debility arising from prolonged exposure to the heat of the sun in the summer and early autumn months, as well as softening the asperities of the more vigorous portions of the year.

In the inland States for obvious reasons they should be upon considerable bodies or streams of water, while hill-walled valleys, the mouths of ravines, the lee side of marshes and ill-drained grounds, the northern side of high hills and mountains and in the Southern States, the northern banks of rivers should be avoided. Granite and the metamorphic rocky formations are generally healthful, while soils that hold moisture are those to be avoided. Bordering forest trees may have an equalizing influence upon the temperature by breaking the cold winds in cold climates and cooling the ground in hot climates.

All camps for instruction should be provided with a complete and rational system of sewerage, and all barracks, mess-houses, hospitals, lavatories, etc., should be located with that end in view. The exigencies of military service often compel the use of impure or polluted water, but such exigencies should not occur in camps of instruction.

The water supply should come in pipes from some distance beyond the actual area of occupation, and its place of storage and source of acquirement be positively protected from all probable possibility of contamination or infection. In camps for instruction there should be an allowance of at the least ten gallons per capita for all purposes except closets and baths; for these an increased allowance of fifteen gallons should be computed, and for hospitals still greater. Public opinion and convenience demand an ample water supply and more or less efficient systems of sewerage in all summer hotels and shore resorts, where the patrons are free to come and go as their inclinations dictate, and why should there not be greater protection by sanitary provisions for those who give up individual liberty to serve their country? The State provides sanitary protection and simple hygienic conveniences for the criminal within its walls; why not be as generous in providing comfort for and protecting the good health of her volunteers?

It is not an absolute necessity for the parade or drill grounds to be contiguous to the men's quarters. Anywhere within a twenty minutes' march would seem to the writer reasonable and practicable. Barracks should be located with the essential object in view of giving them warmth, light, dryness and floor space. One building should not shadow another and there should be ample space between them for the free passage of the wind, while in hot climates they should be raised a few feet from the ground for the circulation of air, and have broad verandas attached.

Walls and ceilings should be lime-washed before each period of occupation, and floors should be mopped daily with as little water as is absolutely necessary. All bedding should be exposed to the sun for several hours once or twice a week, and blankets be aired every day, weather permitting.

Rations should never be served or allowed in quarters. All walks and thoroughfares should be of asphalt, and the floors of mess-houses, kitchens, and lavatories should be of the same material. All liquids, slops and wash water from kitchens should go into sewers, and all refuse from mess-house and kitchen tables, should be put in galvanized iron cans, and in warm weather be removed twice a day beyond the border of the camp, to be consumed, burned or buried. The commanding officer is very justly held responsible for the condition of his camp, and company officers in turn for the policing of their company quarters and the individual cleanliness of their men.

Company officers are detailed in rotation, one each day, under the military title of *Officer of the Day,* to superintend the general policing of the camp. Such officer has command of all the guards and prisoners, and is responsible to the commanding officer for the order and cleanliness of the camp. He utilizes the prisoners in policing the grounds, and when their number is not sufficient for the work in hand, fatigue details are granted him. The result will be satisfactory in proportion to the efficiency of the officers detailed to superintend.

The price paid for the preservation of health, in Camps of Instruction as with bodies of men in the field, whether quartered in tent, hut, or barrack, *must* be eternal vigilance, and the larger the number of occupation, the more unrelenting must be the watchfulness. Such vigilance can only be consummated by a rigid system of policing, supplemented by frequent inspection.

IV. THE VALUE OF THE SCHUMBURG METHOD OF PURIFICATION OF WATER FOR MILITARY PURPOSES.

BY
CAPTAIN JOHN H. HUDDLESTON,
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In March, 1897, Schumburg announced as the result of a year's laboratory work that of the many chemical disinfectants he had tested for use with drinking water bromine gave the only success. He reported that 0.06 gram of bromine kills the pathogenic bacteria in one litre of water in five minutes, and that then the bromine can be neutralized by ammonia so that a clear, tasteless and odorless water results. Resisting forms of nonpathogenic bacteria are not killed, and very hard, extremely dirty and swamp waters neutralize part of the bromine by the lime or the ammoniacal salts contained, and with such waters more bromine must be added even to the point of giving a yellowish color to the water for half a minute. The amount of bromide made by neutralizing the usual amount of bromine is only two or three grains to the litre, an amount too small to give a notable taste to the water or to affect the health of the one taking it. Subsequent papers elaborated the technique of the method. Schumburg found that the bromine is best handled in a potassium bromide solution and recommended the following: R. Kali bromidi, 20.00; bromi, 21.91; aquæ q. s. ad 100.00 for the bromine, and, for the neutralization, tablets each containing: R. Sodii sulphitis, .095; sodii carb. exsic., .040; mannit q. s. Of the solution 1-5 c. cm. is sufficient for one litre and is neutralized by one tablet.

Schumburg gave no experiments to support his statements, but in January, 1900, Pfuhl reported in detail a series of confirming experiments. He tried water from various sources, river, pond and meadow, and added to these waters pure cultures of the cholera spirillum, the typhoid bacillus and the staphylococcus pyogenes aureus. In certain experiments the cultures were not entirely destroyed, but in every such instance Pfuhl attributed the failure to the unusual severity of the test and to the insufficient amount of bromine employed. He noted that it is necessary that the bromine be well mixed by stirring with the water, that the neutralizing salts should be dissolved in water freed from infection before they are added, that when the composition of

the water to be tested is unknown it is safer to add sufficient bromine to give the water a yellow color for two or three minutes, and that as the bromine solution diminishes in strength very rapidly after the containing vessel is opened it is necessary after five minutes to increase the amount of solution used. The bromine method is practically useless when the water contains fecal matter in large enough amount to cause color, turbidity or foul smell, in other words in conditions in which the water would naturally be rejected without question.

Such claims for a practical method of disinfection surely merit investigation, and a number of experiments with the bromine solution have therefore been performed by the writer. For part of these experiments cultures of typhoid have been used from three sources: one was received from Pfeiffer in 1896, which had been continued in his laboratory for some years, one was isolated from well water in 1896, and the third was isolated from the feces of a typhoid patient in the fall of 1899. After it was found, however, that there was no difference in the way these reacted to the disinfectant, only the third culture was used. As the cholera spirillum had apparently been quite thoroughly tested by Pfuhl, and as it had appeared less resistant to bromine than the typhoid bacillus, it was not used in these experiments. Its place was taken by a culture of the bacillus coli communis. In all cases a forty-eight hour culture was used; generally an agar culture was mixed with water, and some cubic centimetres of this mixture was added to the water to be tested, but in a few instances a cubic centimetre of a bouillon culture was used instead.

In the early experiments one cubic centimetre of the water under examination was taken for a test, added to a tube of melted agar, plated in a Petri dish, and placed in an incubator at 37 deg. C. for forty-eight hours. In case no growth was apparent twenty-four more hours were allowed to elapse before the plate was rejected. As it was later found that bromine had but slight effect on the usual saprophytes, large numbers of colonies of spore-bearing bacilli being often found in the media, and as it was feared that a few colonies of typhoid might escape notice, recourse was had to the Hiss tube media. Stick cultures were made from the suspected water and controls from the typhoid culture employed. If the medium was not clouded at the end of twenty-four hours it was inferred that typhoid was absent. In a few instances the Hiss plate medium was also used. Coli plates were controlled in like manner by planting colonies and in some instances a cubic centimetre of the water in fermentation tubes. If no gas appeared it was inferred that the bacillus

coli communis was certainly absent; if gas developed at least some of the colon group were probably present.

Water from three sources was used: Croton water drawn from the tap in the laboratory, Albany water taken from the Hudson River, and stagnant water taken from a pool which had been standing some weeks in a city lot in Harlem. There was also used for experiment sterile Croton water mixed with fresh urine in varying proportions. The three waters were examined for their hardness, and it was found that the Albany water was represented by 3.9 grains of calcium carbonate to the imperial gallon, the Croton water by 7.7 grains, and the stagnant water by 11 grains. The Croton water contains .0030 parts of free ammonia and .0170 parts of albuminoid ammonia to 100.000 parts of water, and the corresponding figures for the stagnant water were found to be .0298 parts of free ammonia and .0183 parts of albuminoid ammonia. In other words, the stagnant water was very hard, contained a large amount of ammonia, and would have been rejected immediately for drinking water even if it had not had in addition a notably bad odor.

The time of exposure of the water to the bromine varied in the different experiments from five to seven and a half minutes.

SERIES I.

No. of experiment.	Water.	Preparation.	Amount in c. c. m.	Ty. Pfeiffer added.	Ty. well added.	Ty. 138 added.	B. col. com. added.	Amt. br. sol. added. 10 = ⅛ c. c. orig. sol.	Culture Medium.	Result in 1 c. c. of water.	Remarks.
1	Croton	Filtered, porcelain filter	500	..	..	..	..	0	Agar	No growth	Control
2	"	Boiled and exposed	"	..	..	..	..	0	"	....	"
3	"	Filtered, porcelain filter	"	+	..	..	..	0	"	T + innumerable	"
4	"	" " "	"	..	+	..	..	0	"	T + "	"
5	"	" " "	"	..	..	+	..	0	"	T + "	"
6	"	" " "	"	..	..	..	+	..	"	C + "	"
7	"	" " "	"	..	+	..	..	5	"	No growth	"
8	"	" " "	"	..	+	.	..	6	"	"	
9	"	" " "	"	..	+	..	..	8	"	"	
10	"	" " "	"	..	+	..	..	9	"	"	
11	"	" " "	"	..	+	..	..	10	"	"	
12	"	" " "	"	..	..	+	..	5	"	"	
13	"	" " "	"	..	..	+	..	6	"	"	
14	"	" " "	"	..	..	+	..	8	"	"	
15	"	" " "	"	..	..	+	..	9	"	"	
16	"	" " "	"	..	..	+	..	10	"	"	
17	"	" " "	"	..	..	..	+	10	"	"	
18	"	Boiled and exposed	"	..	..	..	+	8	"	S + C o	Less than 50 colonies present
19	"	" "	"	..	..	..	+	6	"	S + C o	
20	"	" "	"	..	..	..	+	5	"	S + C o	
21	"	" "	"	+	..	..	..	5	"	S + T o	
22	"	" "	"	+	..	..	..	6	"	S + T o	
23	"	" "	"	+	..	..	..	7	"	S + T o	
24	"	" "	"	+	..	..	..	8	"	S + T o	
25	"	" "	"	+	..	..	..	10	"	S + T o	

(S = saprophyte; T = typhoid; C = coli.)

In the first series of experiments the variants especially observed were the different cultures of typhoid and the varying amounts of bromine solution. In every case 500 c. cm. of water was used, and the bromine solution was so diluted that 10 c. cm. of the dilution represented 1-5 c. cm. of the original mixture.

It was inferred that none of the cultures of typhoid employed offered unusual resistance and that for ordinary drinking water the minimum amount of bromine solution proposed by Schumburg is sufficient to disinfect typhoid and coli while the ordinary air bacteria may be much more resistant.

In the second series other waters were used and the bromine solution was weaker. The solution had been kept for some time in a glass stoppered bottle, but the odor of bromine showed that some had escaped, though unfortunately no analysis was made to determine the loss. As before the bromine was diluted so that 10 c. cm. were the equivalent of 1-5 c. cm. of the original.

Series 2.

No. of experiment.	Water.	Preparation.	Amount in c. c. m.	Ty. Pfeiffer added.	Ty. 138 added.	B. col. com. added.	C. c. br. sol. added 10=1/5 c. c. org. sol. (?)	Culture Medium.	Result.	Remarks.
1	Albany	None	100	..	..	..	0	Agar	S many	Control
2	"	"	"	..	..	..	1	"	S fewer	"
3	Stagnant	"	"	..	..	..	0	"	S immense number	"
4	"	"	"	..	..	..	1	"	S "	"
5	Albany	"	"	+	..	..	0	"	S + T +	"
6	"	"	"	..	+	..	0	"	S + T +	"
7	"	"	"	..	..	+	0	"	S + C +	"
8	"	"	"	+	..	..	10, kept yellow 5 minutes	"	S + T o	62 col
9	"	"	"	..	..	+	10, kept yellow 5 minutes	"	S + C o	37 col
10	Stagnant	"	"	..	+	..	10, kept yellow 5 minutes	"	S + T o	1 col
11	"	"	"	..	..	+	10, kept yellow 5 minutes	"	S + C o	25 col

It was apparent that a larger amount of a dilute solution of bromine is also an efficient germicide; and it was clear that some means must be adopted to determine positively the presence or absence of a few colonies of typhoid and coli. In the next series therefore the Hiss tube media for the determination of typhoid and fermentation tubes for the determination of coli were adopted. The bromine solution was diluted so that 50 c. cm. were the equivalent of 1-5 c. cm. of the original.

SERIES 3.

No. of experiment.	Water.	Preparation.	Amount in c. c. m.	Ty. 138 added.	B. col. com. added.	C. c. br. sol. added $50=\frac{1}{8}$ c. c. orig. sol.	Culture Medium.	Result.	Remarks.
1	Croton	None	100	..	..	0	Agar	S	Control
2	"	"	"	..	..	5	"	S fewer	"
3	Stagnant	Filtered, 3 filter papers	"	..	..	0	"	S+	"
4	"	" " "	"	+	..	0	"	S+T+	"
5	"	" " "	"	..	+	0	"	S+C+	"
6	Croton	None	"	+	..	5	"	S+T o	
7	"	"	"	+	..	5	Hiss tube	S+T o	
8	"	"	"	+	..	8	" "	S+T o	
9	"	"	"	+	..	10	" "	S+T o	
10	"	"	"	..	+	5	Agar	S+C o	
11	"	"	"	..	+	5	Agar and ferment tube	S+C o	
12	"	"	"	..	+	8	" " "	S+C o	
13	"	"	"	..	+	10	" " "	S+C o	
14	Stagnant	"	"	+	..	5	Agar	S+T ?	
15	"	"	"	+	..	5	Hiss tube	S+T o	
16	"	"	"	+	..	10	" "	S+T o	
17	"	"	"	+	..	35	" "	No growth	
18	"	"	"	..	+	5	Agar and ferment tube	S+C+	
19	"	"	"	..	+	10	" " "	S+C o	
20	"	"	"	..	+	50	" " "	No growth	
21	"	Filtered, 3 filter papers	"	..	+	5	" " "	S+C+	
22	"	" " "	"	..	+	10	" ' "	S+C o	
23	"	" " "	"	..	+	15	" " "	S+C o	
24	"	" " "	"	+	..	5	Hiss tube	S+T o	
25	"	" " "	"	+	..	10	" "	S+T o	
26	"	" " "	"	+	..	15	" "	S+T o	

The Hiss media and the fermentation tubes proved satisfactory means of determining of the test cultures, and it was shown that sufficient bromine could prevent growth of even the saprophytes in the stagnant water. A series of experiments was then executed to learn the amount of urine contamination necessary to make the bromine method unreliable and fresh urine was added to sterile Croton water in the proportions of 2, 5, 10 and 40 per cent. These mixtures of urine were then infected with typhoid and coli and exposed to varying amounts of the same bromine solution as before.

Experiments 13 to 17 inclusive were further controlled by adding one cubic centimetre of the water to Hiss plate media and examining the resulting plate microscopically, and even with that considerable amount of water no typhoid colonies were discovered. The colon bacillus proved somewhat more resisting than typhoid, but it was clear that this method of disinfection is perfectly applicable to water in which there is not more than 2 per cent. of fresh urine.

SERIES 4.

No. of experiment.	Per cent of urine in sterile croton.	No. of c. c. m.	Ty. 138 added.	B. col. com. added.	C. c. br. sol. added 50=⅛ c. c. org. sol.	Culture medium. Agar plates.	Result.	Remarks.
1	40	100	+	+	0	Hiss tube	Cloudy S + on plates	Control
2	40	"	..	+	0	Ferment. tube	Gas S + on plates	"
3	40	"	+	..	20	Hiss tube	S + T +	
4	40	"	..	+	20	Ferment. tube	S + C + gas	
5	10	"	+	..	0	Hiss tube	S + T +	Control
6	10	"	+	..	10	Hiss tube	S + T +	Of 2 Hiss tubes, 1 cloudy, 1 clear
7	10	"	+	..	12	Hiss tube	No growth in either	
8	10	"	+	..	15	Hiss tube	S + T o	Plate contaminated
9	10	"	..	+	0	Ferment. tube	S + C + gas	Control
10	10	"	..	+	10	Ferment, tube	S + C + gas	12 colonies
11	10	"	..	+	12	Ferment. tube	S + C + gas	13 colonies
12	10	"	..	+	15	Ferment. tube	S + C +	5 colonies
13	5	"	+	..	0	Hiss tube, Hiss plate	S + T +	Control tube cloudy pl. hd. ty. col.
14	5	"	+	..	5	Hiss tube, Hiss plate	S + T o	Tube clear and no T. col. on plate
15	5	"	+	..	8	Hiss tube, Hiss plate	S + T o	" " "
16	5	"	+	..	10	Hiss tube, Hiss plate	S + T o	" " "
17	5	"	+	..	12	Hiss tube, Hiss plate	S + T o	" " "
18	5	"	..	+	0	Ferment. tube	S + C + gas	Control
19	5	"	..	+	5	Ferment. tube	S + C + gas	5 colonies
20	5	"	..	+	8	Ferment. tube	S + C + gas	2 colonies
21	5	"	..	+	10	Ferment. tube	S + C o	3 colonies
22	5	"	..	+	12	Ferment. tube	S + C o	2 colonies
23	2	"	+	..	5	Hiss tube	S + T o	4 colonies
24	2	"	+	..	8	Hiss tube	S + T o	6 colonies
25	2	"	+	..	10	Hiss tube	S + T o	21 colonies
26	2	"	+	..	12	Hiss tube	S + T o	12 colonies
27	2	"	..	+	5	Ferment. tube	S + C o	9 colonies
28	2	"	..	+	8	Ferment. tube	S o C o	No growth
29	2	"	..	+	10	Ferment. tube	S o C o	No growth
30	2	"	..	+	12	Ferment. tube	S + C o	3 colonies

Two controlled experiments were made with larger amounts of water and undiluted bromine solution and the results were the same as with smaller amounts.

SERIES 5.

No. of experiment.	Water.	No. of c. c. m.	Ty. 138 added.	B. col. com. added.	C. c. br. sol. added.	Culture Medium.	Result.	Remarks.
1	⅕ Stagnant ⅘ Croton	10000	+		0	Hiss tube	Clouded	Control
2	⅕ Stagnant ⅘ Croton	10000	+		4	Hiss tube	Not cld.	
3	Croton	10000		+	0	Ferment. tube	Gas pro.	Con.
4	Croton	10000		+	4	Ferment. tube	No gas	

To learn something of the effect of the treatment on the taste of water a series of glasses was prepared with Croton water, and water treated with amounts of the bromine solution and neutralizer varying from the normal amount proposed by Schumburg to five times that amount, and this series was tasted by six persons with the result that some of the series tasted a little either "salty" or "earthy," or, as several said, like "stale Congress" or Vichy.

The experiments performed therefore have given results quite in accord with those of Schumburg and Pfuhl. The failures have emphasized some of the limitations of the method without discrediting it, and to one having in mind the typhoid bacillus as the one whose destruction is particularly desirable the results are most encouraging. The method is not one which may be expected to make cess-pools or even puddles drinkable, though it was shown that if sufficient bromine is added it is possible to make even the stagnant water under experiment sterile. That water which has become infected with typhoid but which is otherwise good drinking water may by this means be made a safe source of supply would seem to be demonstrated. The occasions on which just this is desirable are numerous. Schumburg suggests, as notable instances, barracks and camps in infected localities, and vessels taking on water at suspected ports. As to the practicability of the method it may be said that, most important of all, it is rapid, then that the solutions are easily made and not expensive. Bromine retails at from sixty-five to seventy-five cents a pound. The solution must be kept in sealed vessels and preferably in vessels which hold just the amount to be used for the special emergency. Schumburg has devised a military pouch, like an orderly pouch, intended to serve for the preparation of a day's supply of water for a regiment of twelve hundred men. The pouch contains tubes of the bromine solution, neutralizing salts, measuring vessels and stirrers and weighs about four pounds. A Sergeant requires one tube of solution and one tube of salt for his company, empties each into a litre of water, and gives ten cubic centimetres of the bromine water to every soldier as he files past carrying a litre of water. The soldier stirs the solution for five minutes, and then filing by again receives the proper amount of the salt solution and in two minutes more the water is fit to drink. In conclusion I wish to express my obligation for kind advice and assistance from Drs. W. H. Park and R. J. Wilson and for chemical analyses performed by Mr. J. P. Atkinson.

V. SOME EXPERIENCES AND SUGGESTIONS.

BY

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Can the typhoid bacillus be recovered always from water infected by it? Is there a proof by chemical or bacteriological examination of water than can say positively that the bacillus of typhoid does not exist in that water, unless indeed it be distilled water? I believe the answer is no in each instance. I speak of this because of the following statement published December 9, 1899, in Philadelphia Medical Journal by an Acting Assistant Surgeon of the U. S. Army: "The laboratory experiments there made and since confirmed by researches at the Army Medical Museum show that to the water supply of Chickamauga Park cannot be laid the blame of typhoid there." It would be interesting to know what experiments were made.

I think that Dengue was present in our camps during the war. I myself had typical typhoid fever some years ago and did not have it during the war. Nevertheless I had six separate and distinct attacks of dengue-like fever while in the service and within a twelve-month from the time I was mustered out, and my sister had one similar attack, in each case it was due to the handling of camp equipment. Since I have had the equipment disinfected there has been no return. Many others have had a similar experience. There was much undoubted typhoid, too, oftentimes coming on in those prostrated by the other fever. I have written of this elsewhere and my views have been assented to by other surgeons. Let me quote regarding the symptoms of the disease.

" It was an infectious disease. It began with an incubation period of a day or so, suddenly, with chills and intense occipital headache, pain in back, and in bones, high fever (105 to 106 deg.). Mild delirium, insomnia, restlessness and nightmare; occasionally petechia and blotching of the skin. These for three or four days, then a rapid decline of fever. After a few days more, sometimes symptoms of catarrhal jaundice (but usually not). The acute symptoms were over in a week, but the patients were left much prostrated and unnerved, convalescence was slow. The disease was apt to recur, but was not fatal. The rapid decline of the fever, absence of the usual intestinal symptoms,

of the usual characteristic stools, spots, feces, tongue, etc., and the recurrence of the disease, all precluded the idea of typhoid in typical cases. Infection by typhoid came readily to the convalescents from this disease, thus creating much confusion in diagnosis. The disease was dengue, was it not? It was not malaria."

Major Weaver, my brigade surgeon, suggests that these were cases of auto-infection. Was any effort made bacteriologically to identify the disease as dengue?

We have learned by costly experience the need of strict sink sanitation; of pure water; of frequent and authoritative inspections by capable medical officers. We have learned that camps should not be continued too long in one place and that they should be on open ground, not under trees. That division hospitals should take temporary cases and not attempt to care for long continued cases; that hospital trains should convey the sick to civil and general hospitals where better facilities for treatment can be obtained and where the sick can be under the care of trained nurses. These are important lessons, staff and line both should know them well.

I think all the regiments were bothered by malingerers and I would like to call your attention to a plan I tried toward the end of my service. After "sick call" every man marked "quarters" was required to report with his shelter tent and blankets and was directed to camp on a boarded site beside the regimental hospital. Here he spent the day; had his temperature taken, was given medicines, had his meals brought to him by a detail from his company, and made use of a separate hospital sink. He was given complete rest and was protected against the noise and rough usage incident to a tentful of active comrades. At night, if well enough he returned to his company, if not, he was put to bed in the hospital tent. The really ill liked this plan, malingerers soon tired of it.

If such a plan could be supplemented by thorough instruction of officers and men of the dangers of infection, so that every case of diarrhea, for instance, lasting over twenty-four hours could be separated from the company the dangers from disease would be greatly decreased.

The plan of instruction pursued in the 1st Regiment, N. G., P., is modeled after that outlined to this society a few years ago by Captain Myles Standish. One evening of every month the corps and company bearers, hospital steward and surgeon are called together for the following instruction and drill:

Roll call.

Ten minutes' quiz upon preceding lecture.

One-half hour lecture by Surgeon.

Practical demonstration of splint by corpsmen. One-half hour drill with litter, etc., by the Hospital Steward.

Our idea has been to train the company bearers so that they will be able to take the position of corpsmen and the corpsmen that of Hospital Stewards.

In camp I would advise having the sick cared for in Brigade Hospitals. These would be under the charge of Brigade Surgeons and manned by details of hospital stewards and corpsmen from the regiments of the brigade. As far as possible the sick should be cared for by men from their own regiment and seen at least once a day by a Surgeon of their regiment.

The Brigade Hospital should have its own means of transportation, etc., and should have, besides a full equipment of instruments, dressings, medicines and clothing, a formaldehyde disinfecting apparatus and a microscope. By having Brigade hospitals in camp we can become accustomed to the workings and needs of a division hospital in the event of active service.

If we could have it, I would prefer a separate hospital corps company independent of the regiments.

In conclusion I shall sum up the points to which I wish especially to call your attention:

1. The freedom of water from typhoid bacilli cannot be proven by any test now known.

2. The publication of statements dogmatically made without sufficient foundation is misleading and does not tend toward accurate knowledge.

3. I believe that there was a disease present in our camps during the Spanish War, a disease called malaria, Cuban fever, camp fever, etc., that was not typhoid or malaria, but coincided, as far as symptoms are concerned, very closely with the description of dengue given in Osler's "Practice of Medicine."

4. The strict inspection of camps by medical officers is of utmost importance. Junior surgeons, through courtesy or through fear of immediate superiors, are often deterred from complaining of wrongs that should be righted.

5. Division hospitals should care for those temporarily sick; other cases as far as possible should be sent to general and civil hospitals.

6. The importance of instruction of line officers and men in practical hygiene.

7. The importance of so organizing the medical department of the State Guard with a practical working scheme of action for riot and other local duty so that it will have a practical working value, outside of summer camp duty. This in conjunction with

the establishment of brigade hospitals and, where possible, companies of corpsmen separate from the line organizations.

8. The establishment, while in camp, of a school for instruction of medical officers presided over by a regular army officer detailed for the purpose.

I may add that my remarks are made more to elicit discussion upon the points raised than to lay down any rule or law.

VI. FIELD WORK IN THE PHILIPPINES.

BY

FIRST LIEUTENANT FRANKLIN M. KEMP,

ASSISTANT SURGEON, U. S. ARMY.

I do not pretend to present this paper to you as a scientific or learned thesis. It is simply a compilation of facts and observations based upon some months of actual service in the field. They are the gleanings from my own notes written during stirring times, and, I fear, too often impregnated with my own personal equation. This may, perhaps, impress you more with my own egotism than with my desire to impart information. The latter, I sincerely assure you, is my only motive. Should I, at any time, utter what might savor of the self-laudatory, I beg of you to hold what I utter in mind and remember that there are occasions when it is impossible to entirely separate one's self from a subject under consideration, without detriment to the latter.

I arrived in Manila August 23, 1898, and was immediately assigned, as surgeon, to the 14th U. S. Infantry. While the regiment had been greatly enlarged to meet the requirements of recent legislation, it still possessed an excellent groundwork to build upon. I refer to the many older enlisted men who had served as company bearers and who, while at Vancouver Barracks, Washington, had been brought to as near perfection as possible, by that thorough and efficient organizer, Major John Van R. Hoff.

The watchword from the start was "preparation." Every officer, every man that I met, from the first hour I landed until the City of Manila was attacked by the Insurgents on February 4th, was of but one opinion: that the conflict was inevitable, that it would come soon and that no one could foresee its end.

This sense of anticipation of "something about to happen," seeming to permeate the very air we breathed, was so intense and widespread that the teaching of men to save their lives, or those of their comrades when wounded, became one of the most important and, at the same time, interesting, items in their daily routine of duty. Instruction in minor surgery, first aid and transportation of wounded attained a higher altitude than, in my experience, it had ever reached before. Officers who had, in garrison life, assumed an attitude that was sometimes lukewarm—if not actually hostile—could now be seen watching the

surgeon in his daily drill and lecture, eagerly looking for those few practical and simple hints which required so little mental or physical effort, yet which, when learned, meant so much.

The instruction was daily, by companies. All technical terms were religiously avoided. The men were told what wounds are, what hemorrhage is, together with the fact that 95 per cent. of all deaths in battle occur from bleeding at the time of, or soon following, the hurt. That a large per cent. of wounds with hemorrhage occur in the extremities and can be controlled by the use of very little knowledge and the simplest of ways and means.

They were taught this not only didactically, but the latter half of the time was given up to practical work of the men upon one another. They were taught to regard the first aid packet as their most precious possession, after their rifle. They were told that, within three months, many to whom the instructor was then speaking would be counted among the dead; that many more would be wounded, and that some of those who were to die would do so through their ignorance of the principles then being imparted to them and to which they were not, perhaps, paying proper attention. Instances of death from hemorrhage from simple gun-shot wounds of the foot, in this very regiment, through culpable ignorance, during the Spanish campaign, were dwelt upon. The result was that the 14th U. S. Infantry went into battle thoroughly trained in, it is true, but few practical life-saving devices, but these had been so driven into them by months of constant training and repetition, that their performance, when under strong excitement, became almost automatic. To cite an instance:

One old soldier, shot through the femoral artery in Hunter's canal, had the presence of mind, before losing consciousness, to press with his thumb on the vessel, in Scarpa's triangle, and then, with his teeth and other hand, to tear open a first aid packet, correctly apply a tourniquet and dress the wound. Thus every man was a unit unto himself, strong in the assurance that, if he were wounded, he would not die, if it were possible for science to save him; confident that he would not succumb to hemorrhage before the surgeon could reach him; that he himself had it within him, with the aid of a simple "packet" in his belt, to convert almost certain death into a far greater certainty of life.

The memorable night of February 4, 1899, arrived. Within ten minutes from the first "call to arms," every regiment of the 8th Army Corps was in its designated place, forming its own link in the blue-clad chain of soldiers that encircled the City of

Manila, to battle in the open against a heavily entrenched foe, almost 40,000 strong.

Before it became our turn to advance, I had interviewed the necessary commanding officers, who consented to send back their wounded to the Cingalong road, upon which we were then lying. This was the only feasible plan, as it would have been impossible to send forward my hospital corps men through the dense undergrowth with any hope of their rendering efficient aid. This growth changed into comparatively open ground about half-way to the enemy's block-houses and entrenchments, where, when the command reached that point, I felt that my men could render far more effective service. The men of the hospital corps were, accordingly, stationed with litters along the road, and I was soon busy dressing the wounded that came out from the brush-wood, sending them to the left where, in the lee of the Cingalong Church, an ambulance station had been established and did excellent service during the twenty-one hours of fighting, under a hot fire.

After about twenty minutes' work, the wounded having ceased to come back to the road, I started up an open swale leading to Block-house Fourteen, which had been captured but a few minutes before. The Filipinos had evacuated their former trenches and retired to others, from whence they, for five hours, kept up a constant and severe cross-fire, at a distance varying from 100 to 40 yards. To expose one's head during this time meant almost certain death, yet my hospital corps men seemed to be ubiquitous, going from one pit to another, across open spaces, apparently bearing charmed lives. At the end of five hours we charged the second line of entrenchments, completely routing the insurgents. Before this was accomplished, all of the wounded had been dressed, tagged and sent back to the ambulance station 1,000 yards away; all the dead had been identified and this, without a single casualty to any of my sanitary soldiers.

You may attribute this to respect for the Geneva Cross; but you will, I am sure, change your view when I inform you that it was made a special target of; that, even after the last charge, three insurgents in a near-by tree, while the surgeon and two hospital corps men were dressing a wounded man, in the open road, sent at least a dozen shots into their midst, and the firing desisted only when a detachment, surrounding the tree, shot them down like turkey-buzzards.

The lessons I gained from my experience in this engagement were as follows:

First. The necessity for thorough instruction to officers and

men in first aid. This, I am happy to say, was more fully impressed upon me by my success than by any hitch or failure.

Second. The incalculable value of the first aid packet. Ordnance experts—and even the public at large—may give the credit of the small mortality from wounds in warfare to the improvements in modern firearms; but, after all, I am convinced that non-interference—by probing or otherwise—together with prompt dressing on the firing line, has saved more lives than all the changes in the character, size, shape and velocity of projectiles put together.

Third. The necessity for a perfect sympathy and desire for co-operation between officers and men of the Medical Department and the rest of the line and staff.

Fourth. The absolute necessity for more medical officers and hospital corps men upon the firing line. The range of modern firearms is so great that for them to get to safety, which was formerly possible, is now futile, without entirely giving up the most important object for which they exist, namely: the prevention of death from primary hemorrhage and the military necessity of disencumbering the firing line of wounded. The old argument is, therefore, rendered fallacious. There should be a medical officer to each battalion, because they often act separately and one or two of them are then deprived of proper medical aid. The argument that the services of medical officers are too valuable for them to expose themselves could be applied, with more reason, to great generals. What would become of us, then? How would it look and what results would follow if all the officers of high command should retire 3,000 yards to the rear and stop there?

After the victory on February 5, 1899, the 14th Infantry proceeded to the town of Pasay, five miles from Manila, and remained intrenched there, off and on, for a total period of four months. The many sanitary and medico-military problems that presented themselves while living there for such a length of time I must pass over hurriedly. They gave me food for deep thought, however, which my stay at the U. S. Military Academy has only served to intensify. I refer to the establishment, at that institution, of a Chair of Sanitation and Military Hygiene.

Most officers, whether graduates or not, go through the service with practically no knowledge of the first principles of a science the ignorance of which has cost more lives by disease than powder and shot. How can you expect a general to listen to and carry out suggestions from a medical officer that would entail great changes, if that general be ignorant of the cause or prevention of camp diseases so many in number, so disastrous

in their results, so easily controlled by very little knowledge rightly applied? How many officers, for instance, can tell you what ground water is and its influence upon health—of how a camp should be laid out, from a sanitary as well as a military standpoint? of the thousand and one subjects that are constantly brought to their notice, in the field, and are, perhaps, pooh-poohed, while death from lingering, fetid disease, is, meanwhile, producing more dreadful, more direful results, more mourning in the families of the Nation than powder and shot ever did or could?

Upon the 9th of April, 1899, two battalions of the 14th Infantry embarked as part of a provisional brigade commanded by Major-General Lawton, to invade the Province of Laguna, named after the beautiful Lake of the Bay, or Laguna del Bay, situated in Southern Luzon, and of which the Pasig River, which flows through Manila, is the outlet. The embarkation occurred at the town of San Pedro Macati, about five miles above the city; cascos (the large native flatboats) being used, in tow of tugs and launches. Our objective point was the City of Santa Cruz and six or seven towns in the vicinity, situated about thirty-five miles away on the southwestern shore of the lake, all important insurgent strongholds. We arrived off Santa Cruz about 4:00 p. m., April 10, landing under protection of our gunboats on a series of rice fields, about five miles above the town. We had a sharp skirmish shortly after landing, to clear some adjacent woods of a strong body of insurgents, where occurred one of the few instances on record in which the fighting became hand to hand. The next day we captured Santa Cruz and during the days following five or six other towns, returning to Manila April 18, 1899.

This campaign was of vital interest to me, because it was my first experience with Chinamen as litter-bearers. My observations, at that time, were decidedly in their favor and my subsequent study of their many admirable qualifications resulted in the conviction that, for this purpose, in the tropics, they are a decided success. I believe that they should practically supplant, in this duty, the men of the hospital corps who, by higher training, would be of far more value on the firing line, or at the dressing stations. I mention this, of course, with the proviso that they are properly trained and under the supervision of responsible men. My reasons for taking this view are as follows: They are better able to withstand the effects of intense heat and, though, at times, worked apparently beyond the limits of human endurance, I failed to meet with a single case of exhaustion among

them; this at times when American soldiers were dropping by the dozen in battle or on the march.

With proper handling they are willing and even eager workers. Each organization, however, should, in order to gain the best results, keep and handle its own detachment of coolies. Under these conditions, if proper interest be taken in their welfare, they seem to develop an esprit du corps and even a sort of doglike affection for their superiors, responding heartily to every call made upon them. Distributed indiscriminately, however, among large bodies of troops, with a different master every day, often called upon to perform two or three things at once, they become lazy, lose interest and seek every opportunity or pretext to neglect their work. Under fire, they show the usual Oriental stoicism and passive indifference to danger, unhesitatingly and unostentatiously going wherever led, even though it be, apparently, to certain death. They are cheap, they eat very little and they carry their own rations. When these give out, it causes them no inconvenience, as they appear to possess the faculty of living off the country with ease, as they are the most expert of all looters.

The only drawback to their employment as litter-bearers is that the regulation litter is not adapted to the peculiarities of posture and gait assumed by them in carrying burdens. They are accustomed to having the weight entirely on one shoulder, the body inclined toward the opposite side; the line of direction corresponding to one drawn diagonally from the weighted shoulder to the opposite foot. By this method, I have often seen two Chinamen carrying as great a weight as a piano slung on a pole between them and going along at a trot. They are incapable of carrying a loaded litter without slings and, even with this adjunct, the weight seems to bend them forward and exhaust them with great rapidity. This fault can be, in a measure, obviated by passing a pole beneath the litter-slings and suspending the litter between the front and rear bearers. The flatness, however, of the litter and the tendency of the slings to slip cause the patient to be in constant danger of capsizing.

The ideal solution of this problem was presented to me in the Division Field Hospital at Baliuag, during General Lawton's first memorable march into Northern Luzon, culminating in the capture of San Isidro. We remained at Baliuag from May 2 to May 13, 1899, awaiting supplies. During this period, as the natives became less timorous, they would bring in their sick and wounded for treatment. Two bearers would carry the patient in a boat-shaped wicker basket suspended upon a bamboo pole passed through fixed rings at each end, the pole resting upon a

shoulder of the front and rear bearer, respectively. This seemed to fulfill all the requirements of cooly transportation of wounded. The basket is extremely light; its shape and depth, together with the factor of the fixed rings at either end, for the pole, obviating entirely the danger of capsizing. The weight is so distributed as to enable the two bearers to carry the patient with the same ease and rapidity as characterize them in their ordinary daily vocation as human "beasts of burden." Two Chinamen thus equipped, moving as they do with bent knees and upon the balls of their feet, swinging along with their peculiar springy, easy trot, will insure more rapid transportation and less jarring than four men with a litter or even an ambulance could.

I wish to digress a little and, going back to the evening of our landing below Santa Cruz, with the subsequent conflict in the woods on the evening of April 9th, cite an example of fidelity on the part of one poor heathen seldom found, even among white men. I had been allowed ten Chinamen as litter-bearers, together with an additional one as my personal attendant to carry my blanket-roll, haversack, etc., in the absence of horses or other transportation.

Many insurgents, placed in tree-tops, "sniped" at us from flank and rear, and four men in our battalion were boloed. My own particular Chinaman and two others were captured. The last two were at once put to death, but my man, I suppose on account of the heavy bundle he bore, was simply bound and led about a mile into the woods, together with all of my earthly possessions for the trip. That night I borrowed some hardtack for my evening repast and slept without a blanket. The following morning we captured Santa Cruz, after a running fight of six or seven miles. Before we started, while I was disconsolately wondering what I would do without clothing and food, I heard a "Buenos dias, Señor," and, looking up, beheld my Chinaman, with all my belongings intact, with a new Mauser bayonet stuck in his belt that he had not possessed the night before and, sad to relate, minus his queue! It seems that during the night he had worked loose, killed his guard with the Mauser bayonet, secured my things and, after hours of cautious creeping, had found our lines and the rest of the time had been searching for me. After that he stuck to me like a veritable leech.

The advance on Santa Cruz was by a gradual change of direction to the left, the pivot resting on the shore, while the right swung round. When the advance became general, I had the hospital corps men march five or ten paces in the rear of each company and a steward to each battalion farther back. The Chinese bearers were about 100 yards to the rear, under the

charge of a private of the hospital corps, who could swear volubly in Chinese and was further assisted by a huge navy revolver and a long stick; this because the employment of this genus of bearers was still in the experimental stage. The first experiment was, however, a success. They seemed to fear nothing and, once or twice, had actually to be ordered to "Get down!" under cover when the troops were under heavy fire.

On April 21, 1899, I was temporarily detached from the 14th Infantry and placed, by General Lawton, in command of the ambulance train accompanying the expedition led by him into Northern Luzon, resulting in the capture of the insurgent stronghold of San Isidro. We were out thirty-eight days in all, participating in twenty-six engagements, few of which, however, attained the dignity of battles. I never had more than six ambulances at any one time, and was often obliged to use army escort-wagons. The first half of our journey was through country over which wheeled transportation had never passed before. We were compelled to make roads, build bridges, ford rivers, climb precipitous hills, with, sometimes, not even a footpath to guide us on our way. This for two weeks; then into a thickly settled community, where the roads were like boulevards, with daily fighting and the certainty of comfortable quarters for my sick and wounded in some roomy house which the brigade surgeon, going on ahead, would indicate.

My coolies would have the locality all cleaned up before the train arrived, the carts containing the medical, the surgical and the sterilizing chests coming next. In a few minutes the division field hospital would be established and in thorough running order, rounds made, operating table improvised and all dressings and operations performed. Ambulances would be parked and cleaned and made ready for instant use.

Time forbids me to dwell long on this interesting, instructive and arduous campaign. My position gave me opportunity to be almost anywhere I wished, while on the march or in battle, and I was enabled to make some very interesting observations. Naturally, as my chief occupation was the transportation of wounded, anything pertaining to it received my earnest attention; and, while dealing with the subject, I desire to emphatically express my belief in the superiority of the "double-decker" over all other ambulances. Those used in the Philippine Islands, although hurriedly built and presenting many defects—as all ambulances seem to do—more than made up for their imperfections by the fact that they could carry just twice as many wounded back from the ambulance station as could the ambulance of regulation pattern.

The expedition of which I am now speaking broke up at Calumpit, whence I was ordered to make a forced march overland, with my train, into Manila without escort. We started at 2:00 p. m., May 27, reaching Malalos at 6:00 p. m. As the country beyond was suspicious, I decided to push right on by moonlight, which we did, marching until 4:00 a. m. Starting at 6:00 a. m., the 28th, the whole day was occupied in building rafts to cross two rivers. This accomplished by 6:00 p. m., we moved rapidly on to Bacour, where we crossed the railroad bridge, leading the horses singly and blindfolded over the narrow middle planking and dragging the wagons over by hand. We then stopped for the moon to rise and, incidentally, to have a short rest. Renewing our march, we crossed the railroad bridge at Marilao at 1:00 a. m., May 29. At daylight we started on the last stage of our journey, arriving in Manila at 9:00 a. m. This forced march of seventy odd miles was very wearing on man and beast alike; but I felt justified for my rapid movements by the fact that the country was largely unguarded, if not wholly hostile; and my constantly pushing ahead was the surest safeguard against attack. On reporting to General Lawton I was ordered to rejoin the 14th Infantry, at Pasay.

On June 9 we were ordered to rendezvous at San Pedro Macati, as part of the expedition to the Province of Cavite. At daylight of June 10 we set out on the hardest day's march I ever experienced. The plan for the day was to start from the Pasig River, cross the intervening desert and attack Parañaque in the rear. This "desert," as it is called, consists of rolling, hilly land, entirely destitute of water during the dry season, and intersected, at frequent intervals, by ravines varying from ten to fifty feet in depth; add to this the fact that it was covered with rank weeds and grass to one's waist, with absolutely no shade, a temperature of 110 deg., and ten hours of an insignificant yet harassing fire from the enemy, who, in small bands, encircled us all day, and you have a combination hard to beat. Water gave out early in the morning; tongues were so swollen that one could not speak; men dropped down in simple heat-exhaustion or in convulsions, not one at a time, but in squads of five or six. Of a recently recruited regiment, not more than a company went into camp that night. In the 14th Infantry, seasoned as it was, about 40 per cent. succumbed at various times during the day. All I could do was to collect them in batches of five or ten and tell the more rational to guard the others until all were able to walk, and then overtake us.

We did not take Parañaque that night. Had the order been given it would have been impossible to execute it. The next

morning we entered Las Piñas, where we remained until the battle of Zapote River, on June 13. This was the most desperate engagement of the Filipino War. It lasted, practically, all day and marvelous heroism was shown upon both sides. Seven American warships had been unable to budge the insurgents, although bombarding for hours with their heaviest projectiles. Two battalions of the 14th were engaged. The enemy was most heavily intrenched on the opposite bank of the Zapote River, from about two miles above down to where it forked. The river was spanned by a bridge, near this point, and protected by an old six-inch smooth-bore, shooting canister and grape-shot. The greater portion of the troops advanced by rushes, until they were stopped by the unfordable river, and, lying there in the open for over two hours, at thirty-five yards range, they kept the enemy busy, while two companies of the 14th swam the river below where it forked and, also advancing by rushes, enfiladed them out. I accompanied the two companies mentioned and, on uniting with the main body, after the Filipinos had dispersed, found seven killed and fifteen wounded—of the 14th—all of whom had been attended and dressed by Captain Winter, Assistant Surgeon, U. S. A. The first-dressing stations in this battle were situated just where the men fell and it is to the credit of the hospital corps that every man was dressed immediately after he fell.

Before closing, I wish to mention a few facts about the regulation litter in the tropics. In the first place, it is too heavy. The men who are obliged to carry this weighty and cumbersome burden for miles, through rice-swamps, dense underbrush and bamboo thickets, under the rays of a tropical sun, are too often exhausted before going into battle to properly perform the arduous duties that then confront them. The burden is too great for one, while the difficulties that beset two, linked as they would be, in forcing their way through tropical undergrowth, are obvious.

The excessive weight is, in greater part, due to the poles of seasoned wood. In a country where the bamboo is so universal, possessing, as it does, such extraordinary lightness and strength, this defect can be easily remedied. In fact, the presence everywhere of this tree would seem to justify even a further step, namely, the doing-away, entirely, with litter poles as a permanent fixture. It would, then, be possible to have a light, collapsing, folding litter, identical with that now in use minus its objectionable features. All that would be required would be: 1st, a piece of canvas of the same dimensions as that now in use, but possessing a hem on either side large enough for the bamboo poles to be pushed through. 2d. Two braces with

stirrup-legs attached, each stirrup being provided with a clamp tightened down by two thumb-screws.

This pair of braces could be easily carried, rolled up in the canvas. When needed for service, two bamboo poles could be cut and passed through the loops, stirrup-legs clamped on and screwed down, and the litter would be ready for use. The advantages in its favor would be:

1st. Lightness.

2d. Its small bulk.

3d. The fact that one man can carry it.

4th. That, if any part should become broken or unfit for use, it could be replaced and would not mean the loss of a whole litter.

To cut the necessary bamboo, a larger knife than the hospital corps jack-knife would be required. In fact, it seems almost imperative that the old hospital corps knife—or something similar, even though it be the Filipino bolo—be adopted.

There is a crying need for such an instrument and I have often envied the hospital corps of volunteer regiments, many of whom were equipped with the old hospital corps knife, and the facility with which they could perform duties which, without such equipment, would be extremely difficult.

DISCUSSION ON PAPERS OF MAJOR LA PIERRE, CAPTAIN HUDDLESTON, MAJOR HARLAND AND CAPTAIN KEMP.

Major Azel Ames, U. S. V.—So far as the discussion of the papers read is concerned I do not feel competent to add anything of any considerable value. I shall attempt to refer to only one of them, the paper first read. It seemed to me that this paper embodied very many excellent suggestions and not one of us, who has served in the recent war, but what fully recognizes the wisdom and force of the suggestions made and the desirability of a speedy realization in practical operation in various camps of instruction. I greatly regret that the papers which are now on the program and which especially attracted my attention, one promised by Col. Pope and the other by Major Hoff, are not to be read. I especially regret this because very much of the benefit derived from reading papers often comes from the discussions which bring out points such as we have enjoyed in regard to the ophthalmological discussion to-day.

Major Hoff's paper would especially appeal to me because of the circumstances to which the title refers. In Porto Rico,

the field which has especially engaged Major Hoff's attention, I have had a somewhat long experience with those self-same problems. I should have been very glad to have had the Major's suggestions upon them because no man is more competent, from the position of a thorough organizing mind and most remarkable experience, to give us thoughts on this work which we would all appreciate and value. I may simply venture to say, in regard to some of these problems, within my own knowledge, that they have been many and various. They have been touched upon in a most delightful manner by the last paper read as to campaigning in the Philippines. Many of the conditions were no doubt recognized by those who listened to the paper as identical, in some features at least, with those which we encountered in the earliest days of the advent of the troops in Porto Rico. The problems in Porto Rico and the problems in Major Hoff's paper, I should imagine would be interesting as they differ in some respects from any of our other experiences. They appeal to the people mostly, as they are the bulk of the population there, the force of the United States being but a small proportion. From the very earliest moment you could only secure your own immunity from disease by taking care of the health of your less fortunate fellowmen and when our neighbor is one million people it behooves us to take action.

As a new member in this Association I do not wish to criticise but I cannot refrain from referring to one thing. I was for a long time secretary of the American Public Health Association and I find that some of the difficulties with which we there contended also apply to this Association. I refer to the question of papers. Take the papers of the two gentlemen I have mentioned. They are announced on the program and we come here expecting to hear them but are very disagreeably disappointed. Major Hoff's paper, I am informed, is not even in the hands of the publication committee. We had just the same experience in the Public Health Association until we finally took measures to see that this evil would be done away with. It considerably retards the working of the Association and the members become less enthusiastic, remain away from the meetings, feeling that over half of the program, and perhaps the most interesting part at that, will not come up for reading at all. The experience of the American Public Health Association warrants my making these remarks, as that association once nearly went to the wall. I speak of this too, because it seems to me that as we expect to publish a journal, for which we shall require a large amount of matter, it is a good time to take into consideration what our action shall be in regard to these papers

in the future. There ought to be a specific understanding in regard to it so that all papers published in the program will at least be in the hands of the publication committee so that they can be read by proxy.

I regret that I have nothing to say on behalf of the papers except that I especially enjoyed the first paper read and hope that we may have the opportunity to listen to many more like it.

Major Daly, U. S. V.—The Schumburg method seems like a very pretty series of experiments, but I doubt that it is of any practical value. I should hesitate very much to allow that method to be used in any troops I should have charge of. You cannot introduce bromine at the rate of three grains per litre of water into the stomachs of soldiers, surrounded by other dangers, without doing harm. Imagine, if you can, a line of men with their canteens full of dirty water waiting to get their little bit of bromine. What a spectacle it would be. Until we are able to supply the soldier with an artificial India rubber stomach, I think we shall fail signally in attempting to supply him with chemically prepared food and drink. If this method should be used at all, it should be in the army of the enemy. I do not believe that the experiments are such as to warrant any further experimentation with bromine for the purpose of purifying water.

VII. THE TRANSPORTATION OF WOUNDED ON SHIPBOARD WITH SPECIAL REFERENCE TO THE INVENTION OF LIEUTENANT COMMANDER MAHAN, U. S. NAVY.

BY
C. U. GRAVATT,
MEDICAL INSPECTOR U. S. NAVY.

The question of handling and transporting sick and wounded men on shipboard is one that has long and deservedly received the attention and thought of medical officers and others and a number of contrivances for the purpose have, from time to time, been devised. None, however, has been altogether satisfactory. The problem is really surrounded by greater difficulties than one accustomed to dealing with such cases on shore would be apt to imagine. Measures suitable on land have no applicability on a ship where they are hemmed in and controlled by the peculiarities of marine architecture. The first consideration is to get a man disabled on deck or in any part of the ship to the sick-quarters, and the next to transport him from the ship to the shore or another ship. On old-fashioned frigates with flush decks, spacious hatches and broad ladders the first of these was comparatively simple and the second was deemed amply provided for by the cots devised by Drs. Gihon, Gorgas and Wells, U. S. N., based on the principle of confining bands by which a man might be secured more or less immovably and carried about or lowered into a boat without severe jostling. The writer confesses, however, to being forcibly impressed with the crudeness of a scheme which requires a sick or injured man to be whipped over the side of a ship by the same derrick and in the same manner as a bale of cotton or barrel of pork. It is true cots may sometimes be carried down gangway ladders and put in boats, but at best this is inconvenient and often impossible. In a sea way or in case the boat be fitted with a fixed canopy, as steam launches of the present day are, and which are the boats of common use, cots cannot be handled with any satisfaction.

Furthermore, intricate modern ship construction with its subdivision into water-tight compartments, small doors, narrow, irregular passage ways, small hatches, etc., renders cots use-

less for internal transportation. These new conditions brought forth contrivances, like Lowmoor's, consisting of bands and slings by which a man can be secured in a sitting posture and so carried. While good for some conditions they are manifestly unfit for others—such as fractures of the lower extremities, a state of insensibility, etc.; in fact, the very cases demanding extreme care.

Lashing in hammocks and lowering by an ingenious device was proposed by Dr. Stitt of the Navy a few years since and adopted for service use, but was found to be impracticable for various reasons. Simple canvas chutes were then advised, but they have very limited application.

Lieutenant-Commander Mahan designed a stretcher which possesses the valuable and essential qualities of simplicity, ease of construction and efficiency and which seems to surpass all others up to this time. It consists of a light pine board 6.5 feet long, 14 inches broad and 1¼ inches thick, with a wooden batten, several inches in height and thickness, firmly fastened across each end and a little below the middle, and three canvas bands four inches broad so placed as to buckle across the chest just under the armpits, over the abdomen and over the legs. The middle batten takes under the buttocks and gives surprising support. A man so strapped can be put in any position, prone, upright or at any angle, without discomfort or disarrangement of the bands. Near each end of the board rope handles are made by which it can be easily carried through narrow doors, up or down ladders or gangways, and, by means of a loop across the head end, it can be lowered through hatches or over the ship's side. As little more space is occupied than by a man's body, it can be readily accommodated in small boats.

It was first thought the device could not be used for fractured thighs, but in a severe case of this character it was most satisfactorily employed on the flagship "New York" last winter and made transportation easy which without it would have been difficult indeed.

The writer was so well pleased with it on this occasion and others that during his service as fleet surgeon of the North Atlantic Station he advised its use on all the ships of the squadron and believing in its superior advantages would be glad to see it adopted for general use in the Navy.

VIII. A METHOD OF TRANSPORTING THE WOUNDED ON SHIPS OF WAR.

BY

CAPTAIN JOHN C. WISE,

MEDICAL DIRECTOR U. S. NAVY.

The writer while Fleet Surgeon of the Pacific Station presented a paper with this title to the Association of Military Surgeons, but it did not appear, as the meeting was not held in 1898. It was therein contended that the most practicable transportation was that by hand, that no method involving suspension should be considered, even when hand-portage was undesirable.

There can be no question but that occasions must arise when a resort to litters will be necessary. In settling which of those submitted is best adapted for the service we must ever keep in mind the complexities of modern naval construction. In our old type of wooden ship, ladders were easily shipped or unshipped, being fastened by hooks to the coaming, but in modern ships the metallic ladders are bolted and riveted to the hatchway, making their removal difficult. Thus our problem is to send below a stretcher in a hatchway where the ladder remains, for if the hatchway is clear, it is for uses other than those of the medical department. Under these circumstances the writer placed a slide, consisting of two boards battened together over the ladder, and sent the stretcher below upon it. This stretcher with its dimensions is shown in accompanying cut. It consists of a piece of canvas two feet in width, between two poles, running in sleeves (the ordinary form). A steel-bar stretcher passes through the poles at each end, and fastens by a nut and screw. A broad thoracic band attached to the canvas (in two parts) is intended to encircle the chest, and fasten by a lacing with hooks, over the sternum. In use, the feet take against the lower steel-stretcher, the bands are laced over the chest, and the patient is quite secure to be run down the slide. When not in service the stretchers are unscrewed at one end, laid parallel with the poles, and the apparatus is neatly rolled.

A board of officers reported as follows on this method:

1. Simplicity, speed of application, manipulation and transport.

2. Ease of stowage.

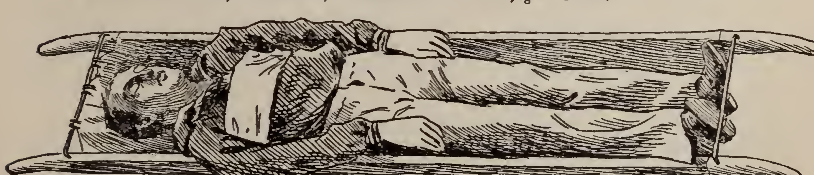
3. Usefulness for shore transportation.
4. Security of the occupant.
5. Suitability to present ship construction.

In the battle of Manila Bay the aids to wounded handled the few wounded with great ease and comfort by this method, and it is believed to represent the simplest solution of this question.

In a prior paper it was maintained that suspension methods will not be used in naval engagements, and no mention of them can be found in the literature of the American-Spanish war. It is quite true that the American squadrons, both at Manila and Santiago, were not taxed by their own casualties, but in the latter engagement the large number of Spanish wounded were cared for by the Americans. It has always been stated by writers on this and kindred topics that the number of casualties in naval actions of to-day would be greatly increased; the results in the actions alluded to by no means disprove this assertion—true it is that the loss fell all on the Spanish side. At Santiago the enemy made no stand, yet he was terribly punished in a running fight. At Manila the result was much the same; the destruction of life on the flagship Reina Christina, receiving with the Castillia, the brunt of the American fire, was appalling. Of the three medical officers carried on Admiral Montijo's flagship, one was killed and another wounded, while the general casualties reached 50 per cent. of her complement.

STRETCHER.

For use with slide in sending wounded below. Length of poles, 7 feet 8 inches; length of canvas, 6 feet 2 inches; width between poles, 2 feet; width of band, 8 inches; diameter of rods, $\frac{4}{8}$ inches.



The steel bows pass through the poles and are secured by a nut. When not in use one end of each bow is detached and is laid parallel with the poles, which are enclosed in the canvas and secured by the band and lacing.

IX. THE CARE OF THE WOUNDED ON BOARD A MODERN SHIP OF WAR.

BY
REGINALD K. SMITH,
P. A. SURGEON, U. S. NAVY.

The recent Spanish-American War was so barren of wounds on the American ships that were engaged in battle I would feel that an apology is needed for bringing this subject before this Association, were it not for the fact that there are so many varying conditions on board ship that have to be met and difficulties that have to be overcome that it is of the greatest importance that they should be discussed from a practical point of view, and it is in the hope that this paper will elicit such discussion that it is written.

There is a wide difference in the difficulties experienced in arranging the wound stations and means for handling the wounded on different types of ships of war; means used on ships of the first class not being applicable to those of the other classes or to monitors.

The natural division of this subject, as it presents itself, is: (*a*) preparations for battle, (*b*) care of the wounded during battle.

The preparations for battle are again subdivided into remote and immediate preparations.

The remote preparations consist in the instruction of the crew in the proper methods of rendering first aid to those who are wounded, in getting a sufficient supply of surgical materials for dressings, anesthetics and stimulants, and working out a method of handling the wounded in the quickest, simplest and most practical manner as applied to the individual ships.

For each ship there should be a station bill for general quarters, consisting of wound stations, handling wounded, distribution of first-aid dressings and stretchers, as applied to that particular ship, which should be transferred to each relieving surgeon.

The training of the crew to give proper assistance to a comrade when wounded is of the greatest importance as in the vast majority of cases they will be nearest the person struck. Instructions in the means of stopping hemorrhage when carried out in a thorough manner should consist in requiring each mem-

ber of the crew to be able to apply a tourniquet to the extremities, manual pressure to all parts, compress and triangular bandage to body and head and digital pressure over the line of the carotid arteries when hemorrhage is from wounds in the neck.

The only form of tourniquet that is to be thought of from a practical standpoint is that made of a piece of *new* half-inch rubber tubing cut into desired lengths. The field tourniquet which has been used in the past is worse than useless.

In wounds of the neck the instruction given is to turn the head to the side on which the wound is situated and then place the ball of the thumb to the inner side of the sterno-mastoid muscle, and thus above the clavicle, pressure being made directly backwards until the blood ceases to flow; in the event that this does not stop the hemorrhage to put the finger directly into the wound and thus stop the bleeding.

This method of dealing with secondary hemorrhage was carried out successfully in a case following gun-shot wound of the neck on no less a personage than William the Silent, Prince of Orange, in the latter part of the Sixteenth Century, by Botalli, physician to the Duke of Anjou.

Aids should be carefully taught to handle the wounded *gently* and to carry them evenly in moving them from one part of the ship to another, as it will be necessary for them when the surgeon is not present to see that the wounded are properly transported.

The most practical means for moving the wounded, in my opinion, is to use a narrow stretcher which has a broad strap which buckles across the chest, underneath the arms, and a small steel rod at each end to hold the handles apart, and against one of which the *feet* of the patient rest (the model shown by Medical Director John C. Wise, U. S. Navy, shows the litter that I speak of, and gives a far better idea of it than a mere description would). In passing from one deck to another, a broad slide is used, upon which the stretcher may be slid down or hauled up through the hatch, the patient being firmly held in place by the band across the chest; there is no jarring, no rope to give way or to get entangled, no tackle to get out of order, and the rapidity with which a man can be put in the stretcher, transported to the wound station and placed on the operating table is far ahead of anything that I have yet seen. The cost is very small, and they can always be made on board ship.

Means for removing wounded from the fighting tops and from the turrets will have to be worked out on each ship, according to the necessities of the case; but the use of an improvised

"Lowmoor" jacket, or a narrow board, so arranged that it can be raised or lowered with tackle, will, as a rule, meet all the requirements.

The supply of surgical materials for dressings should consist in a sufficient number of "first aid packages" so that each man on board may have one, an abundance of sterile gauze, cut into sizes and shapes to be applied to any part of the body at once, and stored in jars or cans labeled "Dressings for the head, neck, body, upper and lower extremities."

Ligatures should be cut into desired lengths, all needles threaded and the balance put in sterile wide-mouth bottles. Drainage tubing, "Murphy buttons," gauze "sponges," basins, tables, solutions of bichloride of mercury, boracic acid and normal salt solution should be prepared so as to be ready for use at once, as time is the important element in treating a large number of wounded.

A large supply of both ether and chloroform should be on hand and this should be divided into several portions, and all that which is not for immediate use placed below the protected deck for safe keeping, otherwise they might be destroyed, in which case we should be in a very poor condition to properly treat wounds.

The immediate preparations consist in so distributing the surgical material and other means of treating and transporting the wounded to the wound stations that we can make the most use of them.

The question of wound stations, where the wounded are to be brought for dressing, and which serve as a source of supply, is one of the greatest practical importance, and one that has to be solved differently on ships of the different classes; on some being comparatively easy, while on others it is very difficult with the number of medical officers that are available. There are certain general features, however, that are essential in the selection of the station, the first of which is accessibility, the next is space, then comes light, and, last, protection from gun fire as much as possible. The first is not always obtainable except where we have a multiplicity of stations, which means that the surgeon must go from one to another as the occasion may require; the last is impossible unless we go below the protective deck, which is not feasible, while we can always get plenty of space in our larger ships and light we can control on all of them. The sick bay is used as the principal station where the supplies are kept and where the operations will be performed after the battle is over, provided it is not destroyed by a shell. The next station should be on the gun deck about

amidship, or as near there as possible, so that the wounded can be brought to it from both fore and aft, and near a hatch so that we can get light and be near the opening through which the wounded will come from the superstructure. On the berth deck there should be another station where it will be most useful; at the base of the turret, in the manipulating room, arrangements should be made for treating those who may be wounded in the turrets. In the engine room there should be issued, as on deck, one first aid package to each person, and these should be placed in a convenient spot. There should be a sterile solution of soda bicarbonate, with directions for use in case of burns or scalds, and some aromatic spirits of ammonia and whisky, the latter to be issued only to those who have become exhausted; the men should be cautioned not to use oil on burns that they may receive, as it will only protract their recovery and complicate their wounds with septic material.

The wound station should be supplied with two tables, one of which may be swinging, such as used by the men as mess-tables, basins for instruments and solutions, bags for irrigating wounds and injecting salt solution under the skin, tourniquets, gauze, splints, instruments, ligatures, stimulants, solutions of morphine and atropine, strychnine, cocaine, eucaine and "Schleich's" solution No. 2, stock solution of bichloride, tincture saponis viridis, and an abundance of sterilized water, which is stored in casks, buckets or beakers.

In the rear of each gun is placed a stretcher, such as mentioned above, and a white bag with a red cross on it, in which are placed the wound packages, tourniquets and triangular bandages for use as "first aid."

The battle having begun, shall we confine our attention to those who may be brought to us at the wound station, or shall we use the station as a source of supply and go from one part of the ship to another and see that the first aid dressings are properly applied by doing it personally?

A combination of these methods will, I think, be that which will work out most satisfactorily. Remaining at the wound station until the wounded are so numerous that to transfer them to the station will seriously impair the working of the guns by taking away men who are needed to handle them must be thought unwise.

It is in this connection that one of the strongest arguments against moving any of the wounded during the fight is met with, as the crews of our ships are not so numerous that we can spare many men from the work assigned to them without seriously injuring the efficiency of the ship as a fighting ma-

chine. The statistics from the known casualties that occurred on the Spanish ships at Santiago would go to show that on the ships that are defeated the casualties will be much higher than on those that are victorious, and that the percentage of the killed will exceed that of the wounded; thus out of four hundred and seventy-four casualties on the Spanish ships, not counting those who escaped into Santiago, there were three hundred and twenty-three killed, or 68.33 per cent., and only one hundred and fifty-one wounded, or 33.66 per cent. The total number of casualties on the American side during the entire war was only eighty-four, including those killed and wounded on shore, of which sixteen, or 19 per cent., were killed, and sixty-eight, or 80.95 per cent., were wounded, of which two, or 2.91 per cent., died as the result of their wounds.

Our treatment of the wound in any individual case will differ in a slight but most important degree as to whether it is dressed at the wound station or away from it. At the station the patient is taken from the stretcher, placed on the table, clothing cut away from the part and hemorrhage checked if it still persists. The wound and the adjacent skin is given a hasty scrubbing and is then washed off with a solution of bichoride of mercury, 1 to 5,000, and then with a saline solution; the torn and bleeding vessels are to be caught up and tied, leaving the ligatures long to facilitate finding them when we are ready to apply the permanent dressing, over the wound are to be laid several thicknesses of moist antiseptic gauze, and over this a sterile bandage; if there is a fracture, splints should be applied to prevent any injury to the soft structures by the ends of the fragments.

In the event of a severe hemorrhage or shock the hypodermic injection of a normal saline solution should be practiced, the shock is also to be combated with hypodermatics of morphine and atropine, strychnine and whisky, or brandy; the patient is then placed at one side and under the protection of anything that may be near. In even a severely wounded person this temporary treatment can be carried out in a very few minutes.

When the wounded are treated at the place where they fall, it is not possible to give them the washing before proceeding to dress the wounds; in this case the clothing is cut off and the bleeding is stopped by pressure, position, tourniquet or catch forceps, or a combination of them. The arteries should then be caught with forceps and torsion applied, provided the artery is in plain sight and it is not necessary to finger the wound, which is only to be done when absolutely necessary to

save life, and then the finger should be wrapped in a piece of gauze to protect the wound from infection as much as possible. It is preferable, however, to rely upon the elastic tourniquet to control hemorrhage rather than run the risk of infecting the wound by the use of the unclean fingers. The hemorrhage having been stopped the wound is dressed as at the wound station, except for the washing, and the man moved out of the line of the ammunition supply or gun fire and into the shade, if there be any, and left there until he can be moved or assisted to the wound station.

After the battle is over, or if there is an interval such as occurred at Manila, the wounded are to be treated as rapidly as possible on the generally accepted principles of aseptic surgery. The wounds being thoroughly cleansed, the blood clots turned out, ragged edges trimmed off, bone, fascia and muscle brought into apposition and the entire wound closed without drainage where it is possible and with it when in the interest of the patient to use it. Wounds of the brain, pleural cavities, abdominal cavity and its contents being treated by the methods specially applicable to the wounded part, always seeking to secure that result which is the reward of perfect asepsis, union by first intention.

X. AN EMERGENCY LITTER OR COT.

BY

CAPTAIN GEO. J. NEWGARDEN, M.D.,

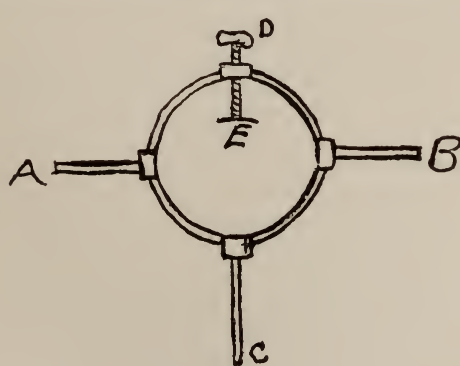
ASSISTANT SURGEON, U. S. ARMY.

In choosing this subject for a paper I have been actuated largely by observations forcibly and indelibly impressed upon my memory during the Santiago campaign of July, 1898. At that time means of transportation for the wounded were mainly conspicuous by their absence, to say nothing of the lack of facilities for the physical comfort of the helpless unfortunates upon reaching the field hospital. As is well known, but three ambulances were with the expedition when the fight was on and but few litters. It is also well known that this was due to no fault of the medical department, since many more were provided, but not transported. Ambulances and litters are heavy and cumbersome things and take up considerable space with an expedition embarking on transports and about to force its way through a tropical jungle. For this reason, no doubt, many necessities were left behind. When the occasion arose for their use, however, how sad was the realization of their absence. In my dressing station at the so-called "Bloody Ford" during the fight for Santiago, hundreds of wounded men, many of them desperately so, and all in a greater or less condition of shock, had nothing but the wet, soggy ground to lie upon, at a time when a litter or cot was most needed. A great number were obliged to remain so over night as well, being too desperately hurt to stand transportation except on a litter, with bearers. Upon eventually reaching the field hospital the majority of them again had the ground for a bed. This campaign has urgently taught us that some means of conveyance for the wounded at the extreme front must be provided and in sufficient numbers, and the nearer the firing line this can be brought the less the amount of suffering entailed.

The regulation litter is an admirable one for ambulance work and for purposes of drill, but I venture to say that very few will ever really find their way to the firing line. It is heavy and cumbersome and will sooner or later be left behind. Recognizing this fact, others before me have endeavored to devise something to take its place with the moving forces, leaving it in its proper place with the ambulance and hospital stations.

Theoretically, many of the results were excellent, but the objection due to bulkiness remained with all and that is what must be overcome before a serviceable substitute will be found.

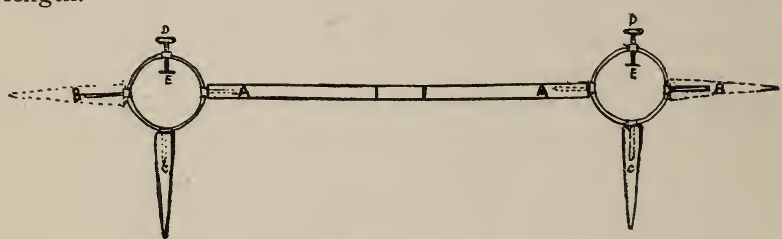
With this end in view, I have started in on new lines, and looked about me for material from which to form an emergency litter or cot without adding materially to the amount of supplies necessary to be transported. To begin with, every enlisted man carries as part of his personal equipment a shelter tent half, together with an upright pole in two parts, and five tent pins, with which to erect a tent when buttoned to the half carried by his comrade. It occurred to me that this large, strong piece of canvas could be utilized and would answer admirably, without much modification, for the litter bottom. If so, we have it within easy reach of the wounded, as it is generally carried until hostilities are about to actively begin and then stacked safely in the near vicinity, under proper guard. So far our litter canvas is provided and carried right where we want it, without any addition to the equipment or trouble with transportation. How, now, to utilize it and build from it a litter, keeping always the same thought prominent, to add as little additional material as possible? Why not utilize the upright pole and pins? Four of the latter will answer nicely for feet for the litter. All we still need are the braces and the side poles and a means of holding all rigidly together.



No. 1.

The latter purpose is accomplished by means of a metal ring (see illustration No. 1) with two side pins, A B, projecting in the same horizontal plane and a bottom pin C at right angles to the side pins, all three in the same vertical plane. Perforating the top of the ring is a thumb-screw D, with a flat

disc, E, at its lower end, by lowering which, the caliber of the ring can be encroached upon. This thumb-screw is for the purpose of rigidly fixing poles of less diameter than the ring. The inner diameter of the ring is to be about $1\frac{1}{2}$ inches. One of these rings will be required for each corner of the litter, making four in all. The lower pin, C, is to accommodate the foot of the litter at each corner, a tent pin bored out at the thick end to slip over the metal pin answering the purpose. The internal horizontal pin, A, for one end of the brace, the latter to be made of the upright pole of the shelter tent cut down to proper length.



No. 2.

When the canvas is to be used as a tent half, the foot to be taken off the vertical pin below and slipped over the external horizontal pin B (see illustration) at either end, making a continuous pole, which will, however, be a few inches longer than the tent can accommodate as an upright. This difficulty is overcome by sinking one end of the pole the required distance into the ground. The only things remaining to be considered to make the litter complete are the side poles. These I have concluded it is unnecessary to supply. The fact must not be lost sight of that this device is merely to be used as a field litter in emergency work. Our sick and wounded in this country are all cared for in posts and general hospitals where everything necessary for their care and comfort is amply provided. As the main bulk of our field work, practically all at the present time, is carried on in tropical climes, where bamboo grows plentifully and within a few minutes' reach at most, the ideal side pole is always handy and may be had for the cutting. There is nothing that would better answer the purpose than this same bamboo. Cutting two of them, each about seven and a half feet long and one and a half inches, or slightly less, in diameter, the litter is finished and simply requires putting together.

The shelter half is doubled lengthwise and laced together by its long edges, giving us practically a bag open at both ends. Slipping the poles through this open bag, then placing the metal

rings with the end braces in place on the inner pins, over the extremities of the bamboo poles, at the four ends, about nine inches in from the extreme ends, screwing down the thumb-screws firmly on the poles to hold all rigid, and putting the pegs on the vertical pins, we have a double-bottomed litter or cot complete. The only extra equipment used consists of the four metal rings which, cast of aluminum, that metal being sufficiently strong for the purpose, with iron pins and thumb-screw, will weigh all four together about twelve ounces and could safely be made even lighter in weight. With this addition to the equipment of each man, he would have at his command a cot or litter and at the same time his shelter half complete as before, as it can be used interchangeably. Nothing has been lost or sacrificed and but little added, yet in my opinion much gained. It is a noted fact, and has been from the earliest days of mankind, that more lives are lost during warfare from disease than from injuries, by an overwhelming majority. Statistics following our Cuban experience and during the present time in the Philippine Islands, show that a great many of the complaints peculiar to the tropics are due originally, in whole or in part, to sleeping upon the ground. In permanent or semi-permanent camps where wall tents or other shelters are provided, each man can unfold his shelter half and instead of foraging dead grass and leaves to make his shake-down, cut a couple of bamboo poles or other saplings and make for himself a comfortable cot in much less time and retire to rest and relaxation, arising in the morning refreshed and ready for a hard day's march if necessary, instead of with chilled and aching joints.

In actual field campaigning the shelter tent will very likely be used as such. Even then the soldier is no worse off than he is at present. The point will no doubt be raised that the additional weight to the equipment is a serious objection. It is a matter of an extra twelve ounces or even less. It has been my experience from observation that unwieldy and bulky articles are much more of an encumbrance on the march than weighty ones. The man never complains of the weight of his loaded ammunition belt, but of the bulk and ungainliness of the rest of his pack. The four rings can easily be slipped into the haversack, filling spaces that already exist, without increasing the bulk a particle.

Grant, however, that the objection did seriously exist. It would be but a small matter to take along the rings as company baggage. A couple of ammunition boxes full will supply sufficient rings to form cots for a whole company, and add very little bulk to the baggage of the organization.

It may be said to offset this suggestion that the company has already enough material to drag along with it and any extra addition would only be an encumbrance and hamper its movements. Again the boxes of rings may be left behind or mislaid and not be available when needed. Personally I believe that the soldier himself would not object to carrying the extra weight of three-fourths of a pound or less with very little extra bulk, if any, in order to enjoy the immense advantage to be derived therefrom. Admitting, however, for the sake of argument, that all these objections advanced are serious ones. Very well, we will return then to the original idea, that of devising an emergency litter only, of light weight and small bulk, for the handling of the injured at the extreme front. If we have succeeded in this alone, the main object has been achieved. The forming of a comfortable cot for the able-bodied men also was an afterthought, though it appears to me to be quite practicable. The men can carry their shelter halves, pins and poles unmodified, just as they are doing to-day, but simply place a number of holes along the two long edges of the canvas and add a strong lace long enough to lace these two edges together when so required. When not in use as a litter, this lace may be left in place along one edge. The rest of the necessary litter equipment can be made part of the medical department property. Should this be done, the external horizontal pin which was intended for use to make the shelter pole could be altogether dispensed with, and since the question of additional weight to be added to the personal equipment of the soldier would then be eliminated, the remaining pins might be made heavier and stronger, if desired. It is a recognized fact that a suitable litter for field work and active campaigning has always been a long-felt want. The present litter is too heavy and cumbersome to be carried along in any great numbers for such work. The lighter and smaller such a litter can be made, the better for the purpose. In this one suggested the canvas, as stated before, is already carried by the soldier as part of his equipment, and the rings, pins and braces could be added to the field equipment of the medical department and remain in its sole charge. A marked advantage claimed for this sort of a litter is the following: There will be no necessity to move the injured occupant from it until he is ready for operation. He can be placed right upon the ambulance litter if required without necessitating a change from one to the other. The feet can be pulled off the field litter and the canvas with the man upon it laid right upon the ambulance litter and left there, simply withdrawing the side poles after removing the braces and rings. The shelter half then

As a Cot.

As a Litter.

As a Shelter Tent.

accompanies him to the hospital, where it may prove of great value.

Another advantage claimed is that with the shelter half as the litter bottom, of which great numbers will be readily at hand, a very few rings, pins and poles could be made to do a great deal of emergency work between the firing line and the different stations, since all the parts are interchangeable and can be used at any corner and at either end. A lost part does not mean a ruined litter, therefore a few extra parts taken along to meet such emergencies will be all that is necessary.

There are submitted with this paper three photographs illustrating its subject put to practical use as a litter, cot and shelter tent, also a curtailed model showing the manner of assembling the parts. It is not expected that it will meet with unanimous approval, but as stated before it is an emergency affair only, and one cannot demand much for little, considering in this case the small amount of extra material used in its construction. It may, however, inspire some more inventive mind in the Association to improve upon it and probably devise something more serviceable. If so, I shall consider my small effort has not been in vain, for there is nothing more seriously needed in the service than a practical field litter which will find its way in sufficient numbers to the extreme front or firing line.

DISCUSSION ON PAPERS OF MEDICAL INSPECTOR GRAVATT, MEDICAL DIRECTOR WISE AND CAPTAIN NEWGARDEN.

CAPTAIN JOHN C. WISE, U. S. N.—It has often occurred to me how different are the conditions in the Navy from those in the Army. On board ships of war we have, I believe, the best object lessons in prevention of disease that can be known. We have no trouble in choosing a site and we absolutely control the water and food supply. The question of disposal of garbage is entirely under our control. The regulations require the senior medical officer to inspect daily the entire ship, the living spaces, pantries, latrines, etc., and he is expected to point out any infraction of the laws of hygiene, and the executive officer of the ship is empowered to remedy the trouble. The United States ships of war are models of cleanliness. In substantiation of that statement I would point out the immunity from disease that we had at Rio and the comparatively good health of the ships' crews and officers at Manila, where no one was allowed to leave the ships for three months. A striking contrast to this was the condition of affairs on board the Spanish ships which we captured, the Isla

de Cuba, the Manila and the Luzon. The Manila was converted into a transport and we placed fifty men on her. We had more sickness amongst those fifty men than we did on the flagship Olympia. The Spaniards are unfamiliar with what cleanliness is, not only on board their ships, but also in their domiciles. You can scrub, clean and use all the disinfectants you please without achieving any result. I had a letter recently from a friend in Manila in which he told me that even up to this time they had been unable to clean the ships.

I remember when I was an assistant surgeon that on entering the sick bay, I must confess I could not tell whether a man was black or white, it was so dark. To-day you can go to any part of the ship and it is beautifully light, well ventilated and clean. Under these circumstances there is not much for naval officers to discuss in the way of hygiene and we therefore talk only about transportation of the wounded. In my opinion, if the United States Navy becomes engaged with a foe that can fight, we are going to have an abundance of wounded and there will be but little transportation of them. Men who can go below will do so and the others will be shoved aside. The paper I read this morning was written following an order I had received to inspect the facilities for the care of the wounded and the facilities they had for transporting them. This is an exercise of general quarters on board every ship in the United States Navy. The Boardman chair is used as much to send men up the mast as it is to send them down when they are wounded. I believe a little decency ought to be practiced, and that is why I came to devise the apparatus I described. I have been in the service thirty years and I have not yet seen a man suspended in mid-air. In Manila we decided that a man when wounded would be better off to remain where he was than to suspend him in mid-air. Therefore, I look with little favor on anything that will suspend them.

I have here a little model which I think can be sent below on a slide. As there might be some danger of dropping the men off from the slide, I have attached to the apparatus a narrow board to which are fastened bandages. The wounded man can then be strapped down and lowered safely. This question of the transportation of the wounded has been a weighty one in every navy of the world. The British use only hand transportation, the French an elevator. I devised my litter solely for the reason that the litter drill is a part of the exercise on board ship.

BRIG.-GEN. GEORGE M. STERNBERG, U. S. Army.—There is certainly no more important question to the army surgeon than

the transportation of the wounded from the firing line. We must have litters of some kind for such transportation. The aim of the medical department in supplying a litter has been to get one that is both simple and strong. Colonel Alden has worked on this quite extensively. He has reduced the weight of the litter and has insisted on having the very best material so that it might not break. In this country unfortunately we have no bamboo. I think the bamboo pole is the strongest pole for its weight that can be had and it is extremely useful. As to the improvised litters, if you are going to depend upon your rings and those parts of the shelter tent, the essential part, the pole, is left out. You rely on getting that wherever you may be. In certain parts of the world you have the bamboo and you would certainly use it. In other parts the bamboo would not be available unless you take it with you. If you are going to depend upon improvised poles the question would be whether we could not substitute bamboo for the heavy ash-poles we now use.

I want to compliment Captain Newgarden for bringing the subject before you and there may be some very practical idea in using the material he has proposed. Using the shelter tent and the poles of the shelter tent is certainly a very clever idea. In regard to the rings, it occurs to me that bamboo poles which are strong enough would very often be larger than the ring. Therefore you might have some difficulty in getting just the right kind of pole and one that would not break. If they were slender enough to go into the rings it might be a question whether they would be strong enough. When the regular litters are not at the front, we must do the very best we can to improvise one which will answer the purpose of transportation. All medical officers of the Army are instructed to get improvised litters as best they can. If you did not have the rings and shelter tent poles, which could not be taken to the front, you would use for poles whatever you could get, lash cross poles and improvise the litter.

I remember the last battle I was in was far out in Idaho. Colonel Alden also took part in this affair. We met old Chief Joseph. I was asked to improvise the litters with which to carry away the wounded. We had the lodge poles of the tents in the Indian village. They were excellent poles, strong and light, and we lashed cross pieces above and below. I had twenty wounded men and so I had to improvise twenty litters. We had plenty of mules and by 12 o'clock my little train of wounded men was on the way to the nearest post, where they could be comfortably housed. Military men are constantly called upon to

improvise travois and litters. Whether the litter recommended by Captain Newgarden is going to be a practical one remains to be seen. It seems to me that it is a subject well worth your consideration.

MAJOR C. C. FOSTER, Mass.—I would like to ask the Captain how far to the front at Santiago the shelter tent poles were carried.

CAPTAIN NEWGARDEN.—They were left very near my station.

LT.-COL. R. J. FITZGERALD, Minn.—I believe that I am the only one from the Philippine campaign present here this morning. I think that in nearly every case, when on the march, the poles were left at the last rendezvous. I must say that the improvisations made by our hospital corps were much as our Surgeon-General has said. Bamboo was plentiful and the military blankets were always available. The ingenuity displayed by our men was simply remarkable.

MAJOR L. L. SEAMAN, New York.—I think this is the most admirably improvised litter I have ever seen. In the Philippine Islands nearly every Filipino soldier has a hammock. He uses it for sleeping purposes and for carrying his goods. In a fight he slings it on a bamboo pole and uses it as a litter. Those fellows would run forward when they saw a wounded man, lay the hammock flat on the ground and roll the wounded man into it with much more ease than you could put them on an ordinary litter. Then they sling the pole over their shoulders and trot off. The device is very light, you can get the poles almost anywhere, they always have the hammock and they attend to the wounded with great rapidity and with ease to the patient.

MED. DIR. WISE, U. S. N.—I believe that the best litter is the simplest litter. I noticed that Captain Kemp emphasized that point yesterday. The device presented here to-day has one great failing, it cannot be folded and it is not portable, an important feature in military surgery.

LT.-COL. OTIS H. MARION, Mass.—I would like to ask whether the legs of this litter are firm enough to hold a heavy man? I should think that they would slide out when any great weight is put on them.

CAPT. G. J. NEWGARDEN, U. S. A. (closing the discussion). —In reply to our Surgeon-General I will cite an instance. At San Juan bamboo was plentiful and as we had no lumber we built a shack of bamboo, which answered admirably as a hospital for three days. We had a very heavy rain during that time, but the bamboo roof kept out the rain most effectually.

With regard to the legs, the photographs I passed around

show a man weighing 195 pounds on the litter. The lower pin can be taken out if the legs are not to be made use of, but when two men are carrying a wounded man any distance in a hot climate they are going to rest. Just as soon as you put the wounded man on the ground he is going to suffer; therefore, I have arranged the litter to have feet because when the bearers are resting the wounded man is comfortable.

Another question: How near the shelter tents are to the front? As it is now litters must be carried to the front and I think that it is much easier to carry the shelter tents to the front.

Another question that occurred to me when devising that litter was to give the well man a cot, men who are not injured. This litter is merely devised in its present form for tropical services where bamboo is plentiful. Of course, it will not answer in this country unless poles are provided.

XI. THE PRIMARY ANTISEPTIC DRESSING OF CCI-A DENTAL WOUNDS WITH A CONSIDERATION OF SUBSEQUENT TREATMENT.

BY

MAJOR THOMAS J. SULLIVAN,

SURGEON, ILLINOIS NATIONAL GUARD.

The introduction of antiseptic surgery by Lister, based on the hints given by Pasteur and the subsequent scientific researches of Koch and others have resulted in inestimable benefits to humanity. The still greater advances made in recent years contrast most favorably with the past. The thorough antiseptic preparation of the field of operation, and of everything that is to come in contact with surgical wounds, is so perfect that the danger from primary or secondary infection is reduced to a minimum.

Accidental wounds before coming under surgical treatment have received scant attention. An examination of surgical text-books and current medical literature, fails to reveal much precise information on the systematic primary antiseptic dressing of accidental wounds.

In works on military surgery and in monographs, much valuable information may be obtained, fully describing the first aid package, now so generally recognized as indispensable on the battlefield. The works of Esmarch, Nussbaum, Senn and others who have had practical experience, and who have written very fully on the subject, should be consulted for more detailed information.

Lister, in his early work, believed that the air was one of the great sources of wound infection. Later observation showed the incorrectness of this view. A wound may become infected through the blood-current in individuals previously infected, yet when pyogenic cocci are present, healing may take place without suppuration. The more frequent sources from which accidental wounds are infected are the skin, hair, clothing, unclean dressings, such as a soiled handkerchief, possibly containing tubercular, gonorrheal or syphilitic discharges. The placing of court plaster, carbolic ointment and arnica on wounds cannot be too severely condemned.

Unfortunately, lack of scientific training on the part of medical attendants who probe and befinger wounds without proper

antiseptic precautions is met with too often. The general practitioner who, when called upon to attend a case of bullet wound, does not remove a probe from his pocket case, and without any sterilization, attempt to locate the missile, is an exception. Von Bergmann, in 1877, warned the profession against probing bullet wounds, but it is necessary to continue calling attention to the evils of this procedure until this dangerous practice is abandoned.

Water, unboiled, used to dress wounds, is a frequent cause of infection. Warren gives this interesting illustration in his work on Surgical Pathology: Schimmelbusch estimates that the number of germs that settle upon a space a decimeter square amounts to about sixty or seventy during one half-hour's time in Von Bergmann's operating theater. "In a cubic centimeter of the water of the River Spree, which flows past the clinic, it is estimated that there exist about 27,000 germs. Assuming, now, that a boatman should injure his hand and should wait for half an hour in the clinic before it is dressed, he would receive upon the surface of the wound, covered probably with a blood-clot, from sixty to seventy bacteria. If, however, he undertook to "cleanse" the wound in the Spree water and to bind it with a dirty handkerchief, the number of organisms that would come in contact with the wound would probably amount to between thirty and forty millions."

The ports of entry for infection are in the skin and mucous membrane; these ports are the slightest abrasions, so small as to be often overlooked, incisions, lacerations, punctures, and crushing injuries impairing the cutaneous circulation. There is no doubt that hair follicles, sweat and sebaceous glands are, not unfrequently, the ports of entry. The writer sustained a severe infection at the wrist joint through a hair follicle in sound skin from pus evacuated from a long poulticed abscess of the breast. Decayed teeth and the tonsils in children are common portals of infection. Prof. V. C. Vaughan writes to the author of an unpublished case of a boy of ten years, who while playing in a very dirty stream, polluted with sewage, at a time when he was suffering from a carious tooth, became infected by the water. He developed tetanus and received in all about 15 cc. of tetanus anti-toxine. His recovery was gradual but complete. The tetanus bacillus was isolated from the water. Bites of men and of animals and the stings of infected flies and insects are not uncommon ports of entry.

The length of time that may elapse before an infection is absorbed into the general circulation after being deposited on or in the wound, has been the subject of a series of experiments

by Schimmelbusch. He demonstrated in mice inoculated on the tip of the tail with anthrax that amputation high up ten minutes after did not save life, notwithstanding an immediate and thorough antiseptic dressing. An hour and a half after peripheral inoculation, anthrax bacilli have been demonstrated in the nearest lymphatic gland.

The rapidity of growth of bacteria under favorable conditions, such as obtain in a punctured wound in the hand or foot, corresponds in its clinical manifestations with the statement of Cohn—"that a single bacterium divides into two in the space of an hour; then into four at the end of the second hour; into eight at the end of three hours. In twenty-four hours the number will amount to more than 16,500,000. At the end of two days this bacterium will have multiplied to the incredible number of 281,500,000,000. This process, if developed only in part, accounts for the extensive destruction that takes place in a small punctured wound in the space of twenty-four or forty-eight hours. The severity, or mildness of the infection that follows, depends on the variety, quantity and virulence of the infection, and the resistance of the tissues. In all open wounds, such as cuts and lacerations, nature's hemostatics—viz., weakness of the heart's action, contraction and retraction of open vessels and lymph spaces, and clotting of the blood—play a very important part in protecting the individual against the entrance of infection.

Certain staphylococci and streptococci are found in which the pus formation is in excess of their other functions. These are called pyogenic bacteria.

The most common pyogenic bacteria, those of the first rank, are—

Staphylococcus pyogenes aureus.
Streptococcus pyogenes.
Staphylococcus pyogenes albus.
Staphylococcus epidermidis albus (Welch).

In the second rank, both as regards virulence and frequency, are—

Staphylococcus pyogenes citreus.
Staphylococcus cereus albus.
Staphylococcus cereus flavus.

But more common and more important than those of the second group are the micrococcus lanceolatus and the gonococcus. There is a long list of bacilli, the principal ones are:

B. pyogenes fœtidus; B. coli communis; B. typhi abdominalis; B. tuberculosis; B. pyocyaneus.

Statistical statements of the relative frequency with which the pyogenic cocci occur in general in suppurative and septic

affections vary according to the class of cause which predominates. Staphylococcus pyogenes aureus and citreus most frequently cause furuncles, and are common in circumscribed subcutaneous abscesses; streptococcus pyogenes in spreading phlegmon and inflammation of serous membranes; staphylococcus albus most frequently associated with other organisms and especially in the inflammations of the skin.

Tubercular infections entering through a slight or accidental wound are, according to Senn, by no means uncommon. He mentions the case of a girl with good family history, infected on the index finger through a small sore, while sorting rags. This was followed by the well known lymphatic tubercular infection at the elbow joint. He also quotes Honot, who collected six cases; Eiselsberg, four; Middeldorpf reports one of inoculation of tuberculosis; that of a carpenter cut in the knee by an ax, the injured part being dressed with a soiled handkerchief. The wound healed promptly, but the knee joint subsequently presented the usual characteristics of tuberculosis, requiring resection. A microscopic examination of the capsule revealed tubercular bacilli. The writer recalls the case of a wife infected through a scratch on the index finger by sputum from her husband, who died of pulmonary tuberculosis.

Koenig reports six cases; Kraske, two, and Czerny, two of inoculation tuberculosis following operations. The Jewish circumcision operation is responsible for ten cases reported by Lehmann, and three by Eiselsberg, all of which have been cited by Senn.

Volkmann observes that tubercular infections never take place in large open wounds, or at the seat of severe injury, on account of the great tissue changes that take place in the process of repair.

From the above, it is easy to draw the deduction that the abrasions and lacerations children so commonly suffer from are a frequent source of inoculation tuberculosis, and we, as surgeons, should never pass over a slight trauma as of little consequence.

It must be admitted that there are too many in the profession who overlook small accidental wounds and do not resort to primary disinfection and subsequent occlusion dressing. There is no wound so small that it does not require the most careful and immediate attention from the surgeon or medical attendant, in order to avoid the most serious consequences that sometimes follow from infection.

That there are not more destructive inflammatory processes

established is due to the mildness of the infection encountered and the high state of resistance the healthy body furnishes.

The writer, in 1888, assumed surgical charge of the employees of a large meat-packing establishment, employing from four to five thousand men, where every wound, no matter how slight, received a prompt primary antiseptic dressing. From that date to the present time over seven thousand wounds have been under treatment. This method of dressing consists of a freshly prepared solution of corrosive sublimate in the strength of 1-1000 in sterile water. The wound, if open, is protected with a piece of cotton saturated with the solution, and the surrounding parts irrigated thoroughly, after which the cotton is removed and replaced with a larger piece, previously saturated, and secured in place with a bandage. The injured man then returns to his work if the trauma is an abrasion or very small cut. If more severe, he is sent, or, if disabled, conveyed in an ambulance to the surgeon's office, where further surgical treatment may be provided.

In the selection of an antiseptic wound dressing, bichloride of mercury in the strength of 1-1000 has been selected on account of its well-known antiseptic properties. It has not proved toxic, nor has it in any way interfered with healing in accidental wounds in our experience. Carbolic acid in a 5 per cent. solution used as a primary antiseptic dressing has caused gangrene of the foot, necessitating amputation, as observed in an unpublished case occurring in the out-door practice of a Chicago hospital. Caution should be exercised in the use of antiseptics in wounds where large surfaces are exposed to the toxic effects of the chemical employed.

NATURE OF WOUNDS.

These wounds vary from slight abrasions to cuts of various lengths and depths made by sharp knives, cleavers, dies, sheets of tin and iron, rusty and greasy pulleys, punctures made by nails, hooks, saws, machinery and pikes, as well as burns and scalds caused by fire, by chemicals, by hot grease, by tankage, boiling tar, etc.

In the meat-packing industry, scalp wounds caused by rusty and greasy pulleys falling on the head are not uncommon and produce a ragged-edged wound of one or two inches in length. With unclean and sweat-saturated hair carried through the scalp to the bone, such wounds present an ideal field for the growth of microbes, which if left undisturbed for from twenty to thirty-six hours, produce an acute destructive inflammation and toxic disturbance that demand prompt attention. In such a case, a

thorough surgical preparation should now be made the same as if we were to open the cranium; viz., soaping, washing and shaving the entire scalp, followed by a prolonged irrigation and cleaning the wound. If the infection have traveled far, the shaved scalp will reveal the fact by the swelling, redness and pitting on pressure. If the wound is packed with sterile gauze, and the entire infected surface is now covered with sterile cotton thoroughly wet with a saturated solution of crystallized boric acid put on as hot as can be borne, and all covered with oil silk or rubber tissue, secured in place with a bandage, we have the best means of treatment. The hot solution should be re-applied every half hour.

All this troublesome, if not positively dangerous condition, can be avoided by the prompt primary antiseptic packing of the wound with a piece of cotton, saturated with the sublimate solution, and the subsequent regional shaving and suturing with aseptic horsehair and the use of an occlusive, 10 per cent. iodoform collodion dressing with cotton.

What may appear at first to be only a slight scalp wound (if the violence is sufficient) on further and more careful examination may prove to be a compound fracture. No one is justified in examining a scalp wound without first making the most thorough preparation of the hands and instruments. If a surgeon be present at the time of injury, the primary antiseptic dressing should always be applied, as it will very materially assist in controlling hemorrhage by causing contraction of the blood vessels, and will prevent the absorption of infectious material and further wound contamination. We rarely have an infected scalp wound to deal with when treated with the primary antiseptic dressing followed by the occlusive dressing referred to. The saving of time to the injured is great; for work may be resumed at once in case of all scalp wounds without fear of interference with healing. In all cases of compound fractures treated in this manner, there never has been an infection to deal with.

Wounds of the soft parts of the face, trunk and extremities should be treated in the same manner. Wounds of the hands made by knives or cleavers, dividing a part or all of the flexor or extensor tendons, if not promptly protected, are prone to serious and destructive inflammation, followed by tardy healing and partial or complete mutilation of the parts involved. When wounds of the flexor or extensor tendons are dressed by the above method, primary healing rarely fails to take place. Before the above treatment was resorted to, surgeons generally believed that packing-house wounds would always end in serious de-

structive processes, and primary healing rarely, if ever, would take place. At the present time cases from other sources often present themselves for treatment where no antiseptic precautions have been resorted to and where the most serious infections are encountered, terminating in the loss of limb or of life.

Under the method of primary antiseptic dressings, amputation of crushed, sawed and lacerated fingers has never been resorted to. Abundant opportunities for observation have fully demonstrated that a partly mangled finger is of material help to the hand of all persons engaged in using knives and tools, or engaged in any form of manual labor.

In all kinds of injuries of the thumb, no matter how severe, *no portion of it should ever be removed.* Amputations described in surgical text-books are misleading and cannot be too severely condemned. In cuts of the thumb, where there is barely enough tissue left to maintain even a diminished circulation, amputation should *never* be resorted to, for with the aid of a thorough primary antiseptic dressing we can always secure primary healing and thus preserve a valuable assistance to the hand.

The same may be said of all forms of infections of the thumb and fingers. Necrotic tissue and necrosed bone must be removed, but all living tissue remaining can be and should be preserved, and will give a more sightly appearance and a more useful hand. In cases where the patient is not engaged in manual labor and where cosmetic effects only are desirable, typical text-book amputations may be resorted to.

It is not uncommon for employees engaged in operating tin-presses to lose from one-quarter to one-half inch or more of a finger by a large press knife or shears. This promptly dressed at the shop and, later, by a surgeon, with iodoform gauze, and without operative interference of any kind, then with sublimate gauze and a bandage, need not be redressed for ten days or two weeks, at the end of which time on removal of the dressing the finger will present a healthy surface, the end nearly covered with new skin, and in every way better than if amputation had been resorted to.

It is not going too far to say that all of the descriptions and illustrations in the text-books regarding amputations of fingers in accidental wounds are out of place, and have been handed down to the present time as a relic of pre-antiseptic wound dressing. It is safe to make this rule, *never perform a typical amputation of a finger in those engaged in manual labor if the case can be under proper antiseptic treatment from the*

time of injury. Extensive and severe lacerations and compound fractures usually give the best results, if free from infection.

Excellent results may be obtained by prompt action in cases where infections have started, by proper incision and the free use of hot boric acid dressings, heretofore referred to in treatment of scalp wounds.

Penetrating wounds of the thorax should always be treated by the primary wet dressings, to be followed by the usual surgical procedure necessary in such cases.

Nail wounds, in our experience in packing-house surgery, have always been dressed according to the above routine, and we have never had a case of tetanus and very rarely pus-infection.

During the experience in dressing accidental wounds under consideration, we never encountered a case of tetanus infection. This immunity may have been due to the precautions taken, but more likely to the fact that the great majority of wounds were made by new nails that had never come in contact with stable filth and the black street and other dark earths that form the natural habitat of the tetanus germ. In 1895 we did encounter two cases of acute tetanus, untreated and neglected, both of which recovered under the liberal use of bromides and chloral. Both of the men so affected worked in hide cellars. Park states in his work on surgery that no case of acute tetanus under his observation ever recovered.

The after-treatment of nail wounds, when they came under the surgeon's care, consisted in clipping away the thick skin on the palm of the hand or sole of foot; then thoroughly cleaning the wound and applying a new dressing of one to one-thousand wet sublimate gauze and a bandage. After a day or two, the parts are closed with a 10 per cent. iodoform collodion dressing.

In September, 1899, a case of tetanus was seen in consultation, the port of entry being a large surface wound at the knee joint of a boy of ten years of age, caused by being dragged by a street car. This case developed about ten days after the injury, and forty-eight hours had elapsed before the tetanus antitoxin serum was administered. The serum, 120 cc., was used during a period of five days, but the case terminated fatally.

Toy pistol wounds, as we have observed them, are rarely placed under prompt antiseptic dressings, and are often infected with pus microbes before receiving surgical care. Boys' hands are soiled with street filth, and the force of the explosion imbeds the infections deep in the wounds, thus furnishing a most favorable chance for wound and tetanus infection to develop.

Since Von Bergmann published his report in 1887, on the danger of probing bullet wounds, surgeons have discontinued the use of the probe. But unfortunately, so-called "surgeons" in large numbers do more harm by such meddlesome surgical probing than does the original wound. If bullet wounds are properly cleansed at the openings of entrance and exit, then sealed with the iodoform dressing, primary healing will usually follow. This should be the invariable practice when no important structure has been damaged.

Many reports made by Senn clearly show that in abdominal, thorax and joint wounds, complete recoveries usually follow, if the wounds are dressed as described.

W. C. Cornell, chemist, who is in charge of primary antiseptic dressing, says: "I have been in charge of Nelson Morris & Co.'s laboratory since January, 1897. During that time we have treated an average of 600 accident cases a year. These cases have consisted for the most part of knife cuts, bruises and injuries from rusty nails and the general class of accidents common to a packing-house. The method pursued in handling these cases for the last ten years has been, that as soon as a man is injured, be it a slight scratch or a serious wound, he is sent to the laboratory immediately, where the wound is given a first dressing, consisting of a wash with a solution of bichloride of mercury, one part bichloride of mercury to one thousand parts of water, and a compress of cotton saturated with the solution is placed on the wound and bandaged. If the wound is more than of a very slight nature, the patient is sent to the surgeon.

"During my time I have never known a case of blood-poisoning resulting from an injury where the first treatment has been given, and from what my predecessors have told me, their experience has been about the same as my own.

"The men have learned from experience the necessity of having even the slightest cut washed out, and usually come to the laboratory of their own free will. The foremen are all instructed to send even the slightest case to us, so that in the packing-house blood-poisoning is a thing that is almost unknown."

Before concluding this subject, a brief reference to the use of the tourniquet for the prevention of hemorrhage should be made. The Spanish Windlass has been copied into almost every text-book published. If it were applied to a text-book writer but once I am sure further reference would be omitted. It is painful and unscientific and should be abandoned. Where large vessels have not been opened, the primary sublimate dressing with a well applied bandage usually suffices as a hemostatic com-

press. If not, then make compression with an ordinary strap or an Esmarch band after the injured extremity has been elevated; in the extremities always place the compression close to the trunk.

CONCLUSIONS.

1. Extensive experience has shown that the prompt application of the first aid, or primary antiseptic dressing to wounds in the battlefield has prevented the destructive inflammatory processes formerly common and has been the means of saving life and limbs.

2. In military camps or at posts, the wet primary antiseptic dressing should be applied to all accidental wounds immediately after the infliction of an injury.

XII. THE MANAGEMENT OF CONTAGIOUS DISEASES AMONG TROOPS.

BY

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The outbreak of quarantinable disease among troops is always a source of grave anxiety, especially to the medical officers, upon whom rests the responsibility for its care, treatment and suppression. Unless a medical officer has had some experience in the management of such diseases, he is at a loss to know how to proceed systematically, and may omit some very important details. It is the purpose of this paper to attempt to supply the necessary information in such shape as to be of easy reference and available when needed.

No attempt will be made here to deal with the diagnosis and medical treatment of the diseases, as those subjects do not properly belong to a paper like this. The subjects herein treated will be confined to isolation, disinfection, and general sanitary management. Each of the foregoing subjects will be discussed generally, and more in detail with reference to each of the quarantinable diseases. In order to suppress a quarantinable disease the following must be accomplished:

1. Isolation of every case of the disease as soon after its appearance as possible.

2. The disinfection and subsequent isolation of all persons exposed to the infection, and liable to contract the disease, for a period covering the incubation of said disease.

3. The disinfection of all places and articles that have been exposed to infection.

The failure to accomplish any one of these requirements may render useless all the rest.

Upon the outbreak of a contagious disease among troops, the company, battalion, regiment, brigade, etc., according to the extent of the outbreak, should be immediately placed in quarantine, and a thorough system of inspection at once established. This inspection should include every individual from the ranking officer to the humblest camp follower. Medical officers should be assigned to the troops in such numbers as will enable them to make a careful inspection of each individual, at least twice daily.

Every known case of disease and every suspicious case should be at once removed from the proximity of the other troops, and their quarters disinfected. All persons exposed to infection should also be removed and isolated. This having been done, the problem resolves itself into the following questions:

1. What is to be done with the main body of troops among which the disease occurred?

2. Management of the actual cases and persons exposed to the infection.

3. Disinfection of the infected places and articles.

The main body of troops (company, battalion, etc.) should be kept in quarantine and inspected twice daily until the incubation period of the disease has passed and all danger of new cases appearing has ceased. All hygienic and prophylactic precautions possible should be adopted. For instance, if the disease is small-pox, vaccination should be performed; if the plague, the Haffkine prophylactic or the Yersin anti-pest serum should be used. The strictest attention should be given to the hygiene of the camp or post, and especial care taken in the disposal of excreta. Any new cases of the disease should be promptly removed, the quarters disinfected, and all precautions renewed.

MANAGEMENT OF CASES AND SUSPECTS.

By a "suspect" is meant a person that has been exposed to the infection and is liable to contract the disease. The period of detention for a suspect should date from the completion of his disinfection, after the last possible exposure, and should cover the full time of the incubation of the disease.

Isolation.—The simplest method of isolation with troops is the establishment of an isolation camp. This camp should consist of three or more sections having no communication with each other. It is in reality three or more camps under one general management. Its size, location and equipment will depend upon circumstances, but the one herein described may be taken as a guide, as it is applicable to the care of any of the infectious diseases.

The camp consists of: 1. A section for the actual cases, which is called the *Contagious Disease Camp*. 2. A section for suspects, called the *Suspect Camp*. 3. A section to which sick suspects may be removed until the nature of the sickness can be determined; this is called the *Observation Camp*.

Provision should also be made for administrative offices, supplies and cooking. The isolation camp should be located on high, well-drained ground, with grass and trees if possible, and not nearer than one-quarter of a mile to any other troops. The

location should be accessible for the transportation of patients and supplies, and provision should be made for an adequate supply of pure water. The different sections of the camp should be far enough removed from each other to prevent any intercourse between them, and yet near enough for ease of administration. Each section should have its own corps of attendants. It will usually be well to have one kitchen for the entire camp, located at a point convenient to all. The meals can be cooked and sent to the sections in bulk and there distributed. They should be placed at a designated spot for each section, by the kitchen attendants, and left. After the departure of the kitchen attendants they may be removed by the attendants of the section to which they belong.

Supplies for the isolation camp should be deposited at some designated spot, remote from the camp, and left, and thence they are brought in by the camp attendants. The entire camp must be carefully guarded, both day and night. The sentries should be placed as far from the camp, and especially the contagious part of it, as is practicable for the proper performance of their duties. The guard should be a camp to itself, and should hold no communication with the isolation camp or the main body of troops.

CONTAGIOUS DISEASE CAMP.

The contagious disease camp should consist of a ward or wards for the patients, sleeping quarters for attendants and nurses, a mess tent and one or more for supplies, three bath tents, and a tent for the medical officer, who, like the rest of this camp, is quarantined with the patients and not allowed to leave it. The wards should be placed on the side opposite to that from which the prevailing winds come, in order that infection may not be blown across the camp. The mess and supply tents should be on the opposite side of the camp from the wards. If practicable, it is well to enclose each camp and section by a barbed-wire fence about eight feet in height and closely strung. There should be but one opening into each section. Near this opening should be placed the bath tents, and no person should be permitted to leave the camp without having been given a thorough bath and disinfection and wearing sterile clothing. The bath tents should be three in number. In the first the person disrobes, leaving his clothing (which is subsequently removed and disinfected). He then passes into the second tent, which contains two tubs, one filled with warm water, and the other with a 1-1000 solution of bichloride of mercury. He takes a thorough bath in warm water, using soap

freely, and taking especial care that the hair is thoroughly cleaned. After the warm bath he bathes himself in the bichloride of mercury solution, and after drying, passes into the third tent, where he finds sterile clothing in which he dresses. He now proceeds to the gate, where, after inspection by the medical officer, he is allowed to depart without having again come in contact with infection.

SUSPECT CAMP.

The camp for suspects is almost a duplicate of that for the contagious diseases, with this difference, however, it has no wards for patients. The suspects should be segregated into small groups, not more than four persons to a tent. As far as possible each group of four should be kept separate from the rest of the suspects. The object in thus separating them is to lessen the danger of the spread of infection, should a case of the disease make its appearance in one of the groups. Should the disease develop in the suspect camp, the case must be promptly removed to the contagious disease camp, and all persons in the group and any others that may have been exposed to the infection from the case, must be redisinfected and held for a period covering the incubation of the disease, dating from the last disinfection. The tent in which the disease occurred must be taken down and disinfected, with all articles that it contained. The ground covered by the tent, and for several feet around it, should also be disinfected. A convenient method is to pour kerosene oil on the space to be disinfected and fire it. This will effectually destroy any infection. If the tent was floored the flooring must be burned.

On entering the suspect camp the suspect is sent through the bath in the regular way, leaving his clothing in the first tent, taking the warm and disinfecting baths in the second, and putting on sterile clothing in the third. The object of this disinfection is to prevent infection from the clothing worn by the suspect, as it is liable to be infected. As soon as the suspect's clothes have been disinfected they may be returned to him.

On leaving the suspect camp every person must pass through the baths in the same manner prescribed for persons leaving the contagious disease camp. The suspects should be mustered for inspection at least twice daily. The medical officer should go down the line slowly, carefully inspecting each individual. The slightest deviation from the normal condition should be the signal for removing the man from the line, for a subsequent careful examination. Every individual in the camp, including officers and attendants, should be included in each inspection.

OBSERVATION CAMP.

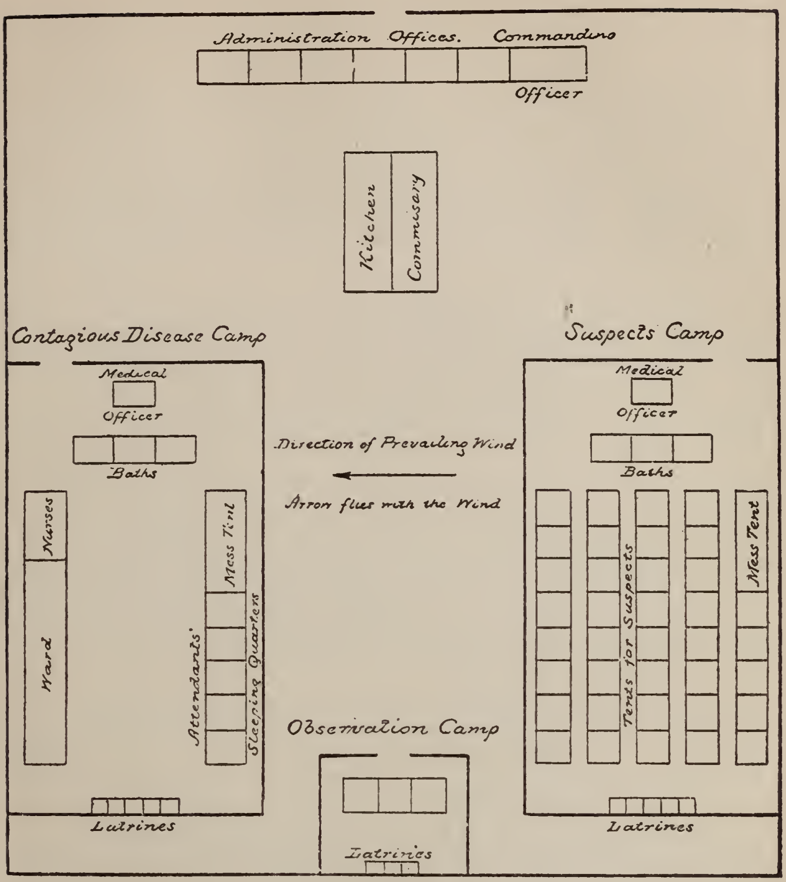
The observation camp is intended for the reception of suspects who develop sickness, the nature of which cannot at once be determined. They are removed to this camp and kept under observation until the diagnosis is made. It would be manifestly wrong to keep such cases among the suspects, and equally wrong to place them in the contagious disease camp until it was determined that they had the disease, therefore the necessity for this camp.

As a rule the observation camp need only consist of two or three tents placed a short distance from the other two camps. When a patient in the observation camp proves not to have an infectious disease, and has recovered from his attack, he may be returned to the suspect camp if his period of detention has not expired, but he must be disinfected as on original entrance. If a patient in the observation camp develops an infectious disease he is, of course, removed to the contagious disease camp, and his tent, etc., disinfected in the usual manner. The following diagram shows a convenient arrangement for an isolation camp:

DISINFECTION.

Disinfection may be accomplished by the following means: 1. Destruction by fire. 2. Exposure to steam above 100 degrees C. (212 degrees F.). 3. Boiling in water. 4. Exposure to formaldehyde vapor. 5. Exposure to sulphur dioxide vapor. 6. Exposure to air and sunlight. 7. By chemical solutions.

The method of disinfection must of necessity vary with the article to be disinfected and the conditions in each instance. In general, the following rules may be observed: 1. Articles that cannot be otherwise disinfected, or are of small value, should be burned. This should include such articles as mattresses and pillows used by patients, cotton comforts and similar articles. 2. All articles that would be uninjured by boiling should be boiled in a 2 per cent. solution of carbonate of soda, or exposed to steam above 100 degrees C. for an hour. 3. Articles that would be injured by heat may be disinfected by formaldehyde or sulphur dioxide vapor, or by dipping in a solution of bichloride of mercury, carbolic acid, or some similar disinfectant. 4. Buildings, etc., when capable of being made close enough to retain the gas, may be disinfected by the vapor of formaldehyde or sulphur dioxide, otherwise they must be made clean mechanically and then washed down thoroughly with a 1-1000 solution of bichloride of mercury.



In order to systematize the subject and supply the necessary information, each disease will now be discussed separately and the essential details for its management and disinfection given.

SMALL-POX.

1. Immediate isolation of infected troops and careful inspections. 2. Removal and isolation of all patients and suspects. 3. Disinfection of possibly infected places and articles. 4. Vaccination of the entire command with glycerinized lymph.

The incubation period of small-pox is 14 days. Suspects

should be detained for not less than 336 hours (i. e. 14 full days), dating from completion of disinfection after last possible exposure. Suspects should be thoroughly disinfected before discharge from detention. Small-pox patients should not be discharged until the skin becomes smooth and all scaling has ceased. Acne eruptions frequently follow the small-pox eruption. It is safer to await its disappearance before discharging the patient. Patients must be thoroughly disinfected and inspected by a medical officer before being discharged from quarantine.

Vaccinate with glycerinized lymph, which is not only purer and less liable to give trouble, but is also surer in its action. A typical vaccination should begin to show inflammatory signs by the end of the third day. The vesicle should have changed to a pustule and have an umbilicated center by the end of the eighth day. A typical vaccination should have first a vesicle, then a pustule with an umbilicated center, *and have an inflammatory zone for an inch or more around its base.* The scab usually falls in 21 days. Scars are worthless as evidence of immunity. No one can tell how long the immunity of even a perfect vaccination will last in a given individual. When small-pox is prevailing every person exposed should be vaccinated, regardless of previous vaccinations. *If the person is immune, the vaccination will not take; if it takes it shows that the person was not protected.*

Disinfection for Small-pox.—1. Apartments infected by small-pox may be disinfected by one or more of the following methods: *a.* Exposure to sulphur dioxide vapor for 24 hours. Burn not less than 5 pounds of sulphur for each 1,000 cubic feet of air space. *b.* Exposure to formaldehyde gas in not less than 4 per cent. strength, by volume, for not less than 6 hours. *Note:* All openings, cracks, etc., must be closed by stuffing with cotton, or by pasting paper over them, or in some similar manner. If it is not possible to do this, then disinfect as follows: *c.* Washing all surfaces with an efficient germicide, such as bichloride of mercury (1-1000), etc.

2. Clothing, bedding, furniture, etc., may be disinfected by one or more of the following methods: *a.* Exposure to steam above 100° C. (212° F.) for one hour. *b.* Boiling in a 2 per cent. solution of washing soda (sodium carbonate); articles to be thoroughly submerged. *c.* Thorough wetting with a germicidal solution and drying in the sun. *d.* Thorough sprinkling with a 40 per cent. solution of formaldehyde and confining in a close space for not less than 12 hours. *e.* Exposure to formaldehyde gas, 4 per cent. strength by volume, for not less than 12

hours. (1 litre of 40 per cent. solution of formaldehyde will evolve about 1,425 litres (50.1 cu. ft.) of gas at 20° C. (68° F.). *f.* Exposure to sulphur dioxide gas (5 lbs. to each 1,000 cu. ft. of air space) for not less than 24 hours. *Note:* Sulphur dioxide vapor will bleach many colored fabrics, and will turn lead paint dark. On this account formaldehyde or some other disinfectant is preferable. Sulphur dioxide, however, is one of the most efficient of the disinfectants, and has the advantage of killing rats, mice, vermin, etc., and is, therefore, preferred on that account.

YELLOW FEVER.

1. Command isolated and inspected. 2. Patients and suspects removed. 3. Disinfection of places and articles. 4. Watch carefully for dengue; where dengue goes, yellow fever frequently follows. 5. Troops should be moved to non-infected territory. If this is not possible, then to the highest altitude available.

Prophylaxis.—Avoid: 1. Chilling of surface of body, especially if wet with perspiration. 2. Excessive exposure to direct rays of the sun. 3. Excessive fatigue. 4. Anxiety and mental distress, especially fear of the disease. 5. Constipation. 6. Excessive use of alcoholic drinks.

Food.—The food should consist largely of vegetables and fruits. Meats should be eaten sparingly, but should be in the form of well seasoned stews with vegetables.

Clothing.—The clothing should be light and of wool, especially around the chest. The white pith helmet is the best head covering.

The following advice may well be given to the troops: "Wear a flannel shirt, keep the bowels open, and don't worry." The rules for disinfection given for small-pox apply equally to yellow fever. The incubation period for yellow fever is within five days. Suspects in marine hospital detention camps are held, however, for ten days, to insure perfect safety.

CHOLERA.

As cholera is spread in much the same manner as typhoid fever, the measures herein given are applicable in some degree to the latter disease. Upon the outbreak of cholera (or cholerine), in addition to the usual measures to be followed for the isolation of troops, cases, suspects, etc., the food and water supply must be the subject of the most careful scrutiny. That both must be absolutely non-infected goes without saying. Preferably all drinking water should be boiled. As boiling

drives off a good deal of the air from the water, it is flat and tasteless. The air can be restored by a simple process: Partially fill a vessel, such as a bottle or cask, with the boiled water, and shake it vigorously for a few minutes, and it will be found that the water is again palatable.

The infection of food by flies is a grave danger. It has been demonstrated that flies can carry infection on their feet and in their stomachs. An incessant war should be waged on them, and they should be killed wherever found. In order to prevent them from getting access to the patient or his discharges, each patient may be surrounded by a cage of mosquito netting. This cage consists of a wooden frame about 8 feet long, by 6 feet wide and 7 feet high; this is covered with mosquito netting, either wire or cotton. The netting should come down to the ground or floor on all sides. The cage should have but one opening, which should close as a door, or be covered by a fold of the netting held in place by a safety pin. The bed should not touch the netting at any point. In each cage should be kept a vessel containing disinfecting solution, into which all soiled articles should be immediately plunged and kept submerged. The dejections should be received in a vessel containing disinfecting solution. Both vessels should have close-fitting tops. Any flies found in the cage should be promptly killed and their bodies thrown in the disinfecting solution.

It is well to avoid the use of a mattress with cholera cases, because it is very liable to be soiled and is hard to disinfect. If the army cot is used, a very comfortable bed can be made of one or more folded blankets. Over them should be placed a rubber sheet or poncho, and this in turn covered by a sheet. The rubber sheet or poncho and the exposed portions of the cot should be washed twice daily with a 1-1000 solution of bichloride of mercury, and the sheets and blankets changed as soon as they are in the least soiled.

The attendants should exercise the greatest care that their hands are carefully washed and disinfected after attending a patient or handling soiled articles. Should any portion of the attendant's clothing become soiled with any of the discharges from the patient, it should at once be placed in the disinfecting solution. The methods of disinfection given for small-pox will be found applicable for cholera. Boiling, however, is usually the most convenient for clothing, bedding, etc. A large iron pot placed near the hospital tent and kept constantly boiling, offers a convenient method of disposing of infected articles. The vessel containing them with the cover on is brought to the pot and the contents, including the disinfecting material,

is poured into the pot and boiled for one hour, after which they are rinsed in one or two waters and hung in the sun to dry. The greatest care must be taken to keep the camp of the patients and suspects clean. Water used for personal ablutions or other purposes should never be thrown on the ground. It should be disinfected and then removed from the proximity of the camp. Lime should be freely used around the hospital and the other parts of the camp.

The incubation period of cholera is within five days. It is, however, well to hold suspects for ten days. Suspects must be watched carefully for diarrhea. A sentry should be placed at each latrine and should record the name and hour of visit of each person using the latrine. A second visit to the latrine within 24 hours by the same person should be reported to the medical officer. This sentry should see that the excreta is received in the vessels prepared for it, and that it is covered by the disinfecting solution. He should have a barrel of disinfectant at hand for the purpose.

Iron ash cans fitted with a seat, having a close cover, make excellent receptacles for cholera discharges. They should be emptied frequently and disinfected before being used again, a small amount of the disinfectant being left in the can. They should be shielded from the sun as much as possible, and have a free circulation of air about them. Lime should be freely used in and around the latrines, and crude petroleum may be scattered about to keep off flies.

The usual inspection twice daily must be made of every individual in the camps as well as among the troops, and care must be taken that the food is properly prepared and is wholesome. It is reported that certain fruits indigenous to the tropics when eaten by newcomers produce dangerous diarrheas. This is said to be especially true of pineapples in the Philippines. Such fruits and also unripe or over-ripe fruit should be avoided.

THE PLAGUE.

The plague is in many respects analogous to small-pox, and the methods employed for the suppression of that disease are largely applicable to the plague. There are, however, other important precautions to be taken with the plague due to peculiarities of that disease. Its virulence, its high mortality, its transmission through the lower animals, and the fact that it is now prevalent in so many countries, among them being the Philippines and the Sandwich Islands, makes plague of especial interest to the military surgeon at this time.

For a more extended discussion of plague you are referred to a most valuable monograph entitled "Bubonic Plague," by Surgeon-General Walter Wyman, U. S. Marine Hospital Service. This monograph is issued by the Marine Hospital Service, and can be obtained on application to the Surgeon-General. This section of this paper is largely an abstract from that article.

1. The plague is an infectious disease caused by a specific bacillus. 2. It has four forms, viz.: *a.* Plague with buboes (bubonic plague). *b.* Plague without buboes (septicemic plague). *c.* Pneumonic plague. *d.* Intestinal plague (rare).

Bubonic plague is the most frequent form; the pneumonic the most fatal. There is an ambulant form of the bubonic plague existent, and it constitutes one of the most dangerous factors in the spread of the disease, as it is so frequently not recognized.

Transmission.—The germ is found in the blood; in pus from buboes, abscesses, wounds, etc., of patients; sometimes in sputum, and more rarely in the stools and urine. It may, therefore, be transmitted by any of the above, or in articles soiled by them or worn by the patient. Food and drink may also serve as the intermediary of contagion. It is transmitted by parasites, fleas, etc., and especially by rats and mice; also by convalescents and by patients with mild attacks (ambulant cases).

How Contracted.—The bacilli enter the body in three ways, viz.: 1. Inoculation (through external wounds or abrasions). 2. By respiration. 3. Introduction into the stomach.

Incubation.—The period of incubation has not been determined fully in all cases. From 12 hours to 4 days is the usual limit, though the disease has manifested itself as late as 11 or 12 days after exposure. I would recommend the detention of suspects for at least 14 days after disinfection, as in small-pox.

Management of the Disease.—With the above facts before us, the questions that confront us are: What is to be done with: *a.* The main body of troops among which the infection has occurred. *b.* The actual cases and suspects.

The Main Body of Troops.—They should be well removed from any other troops, and the guard-lines maintained with absolute strictness. The inspections should be conducted with great care. The number of medical officers should be increased so as to enable a most careful inspection of each individual twice daily, or more frequently if necessary. The inspections should be made by daylight. The men should be mustered *nude* in small squads not exceeding thirty-five men to a squad. The medical officer should take the temperature of each man and make a record of it at each inspection. This is not so hard as

it seems if a number of thermometers are used at one time; of course, washing them before transferring to other mouths.

The chief medical officer should muster all of the other medical officers, *nude*, twice daily, and examine them as carefully as the men are inspected. The plague is no respecter of persons, and medical officers are much exposed to infection. A most careful search should be made for enlarged glands in any part of the body. An enlarged gland is always an object of suspicion. Suspect every cold, bronchitis or pneumonia and disturbances of the digestive organs and watch them carefully, promptly isolating the patient if necessary. Be especially on the alert for mild ambulant cases.

Use of the Haffkine Prophylactic and Yersin's Anti-pest Serum.—When all cases of the plague and all persons known or suspected of having been exposed to the infection have been removed, the remaining troops that have not been exposed, but may come in contact with the disease by the outbreak of other cases or otherwise, should be given the Haffkine prophylactic.

Now just here let me call your attention to a most important point, which should be thoroughly understood before attempting to use either the Haffkine material or the Yersin serum. I quote *verbatim* from Surgeon-General Wyman's article:

"A dose of 5 cc. of the Yersin serum will confer immunity for about 15 days, when it must be repeated. A dose of 1 cc. of the Haffkine material will confer an immunity which is slower in being established, but is of longer but undetermined duration. But the Haffkine material should not be used if the person has been definitely exposed to the plague or is thought to be in the incubative period, for if by chance he is already infected, the Haffkine injection may produce fatal results; therefore, the Haffkine material should be used as a preventive on persons before their exposure, while the Yersin treatment may be used either before or after exposure, or while a person is suffering from the disease. The Haffkine material should not be used on suspects held in quarantine, or on persons definitely exposed to the plague, but it is applicable to persons liable to be brought in contact with plague, and before such possible contact, as quarantine officers and attendants, health officers and employees, and persons in a community where there is a danger of the introduction and spread of the disease."

Management of Cases and Suspects.—The rules given for the management of cholera and small-pox are to a large extent applicable to plague. Especial care must be taken to keep out vermin of all kinds. Rats and mice are not liable to be found in camps of this kind, but if found, great care should be taken

to kill them all and burn the bodies. Flies, fleas and mosquitoes are usually abundant. When bitten by these pests the wound should be washed, disinfected and covered with collodion.

Attendants on the sick should observe the following precautions: Put nothing in the mouth while in the sick-ward or tent. Never take food or drink without first washing the hands with soap and water and a disinfecting solution. Frequently wash the face, and especially the hair and beard, in a disinfecting solution. Rinse out the mouth with a disinfecting solution frequently, and always before eating or drinking. Protect all wounds of the skin, scratches, abrasions, etc., by a coating of collodion after disinfection.

DISPOSAL OF BODIES DEAD OF A CONTAGIOUS DISEASE.

A body dead of a contagious disease is best disposed of by cremation. For sentimental or other reasons, however, cremation is seldom practical, and in lieu of it the following method may be used: The body, without previous washing, should have the orifices plugged, and then be completely enveloped in sheets saturated in a 1-500 solution of bichloride of mercury and placed in a metallic coffin. If metal coffins are not available, one made of wood coated on the inside with pitch may be substituted. After the body is placed in the coffin quick-lime should be put in around the body until the coffin is full. The lid is now put in place and should contain several holes to permit the entrance of water. A layer of lime several inches thick is placed on the bottom of the grave, the coffin lowered, and about a barrel of lime poured over it. Several bucketfuls of water are now thrown on the lime and the earth thrown in and well packed down.

SANITARY CORDONS AND GENERAL MANAGEMENT OF OUTBREAKS OF CONTAGIOUS DISEASES.

Let me make it clear in the beginning that a sanitary cordon is nothing more or less than a guard-line used for sanitary purposes. To the army medical officer who has only to deal with disciplined troops and can use trained soldiers for his guards, the establishment and maintenance of a sanitary cordon is comparatively an easy task. To the marine hospital officer, or any one else who is suddenly required to recruit his guards from the untrained, undisciplined, and frequently unintelligent material that he may find wherever he may be, and with these raw recruits to establish an effective cordon about a panic-stricken disease-laden civilian population, the task becomes simply stupendous. The medical officer in charge of epidemic work occu-

pies the position of the general of an army operating against an enemy in the field, with this difference, however: a human enemy is tangible and is governed by the same restrictions as his opponent. In warfare between men it is a question of strategy and force. The medical officer fighting an epidemic is confronted by a foe, invisible, sleepless, untiring and omnipresent. His approach is heralded by no waving banners, blare of trumpets or panoply of war. Silent and unseen he lurks in every place of vantage, and penetrates our guard-line concealed in clothing, hiding in our food and drink, or wafted in on every favoring breeze.

Confronted by an enemy of this character the medical officer must not only be alert and prepared at every point, but he must also have the power and means to act instantly if necessity requires it; the delay of an hour or even a few minutes may do irreparable harm. Of what avail is the genius of the medical officer if he is hampered by rigid rules and regulations, and handicapped by lack of power and supplies. Responsibility and power should go hand in hand. When an epidemic occurs among troops the medical officer should be given the supreme command of the situation, and all rank and authority waived in his favor for the time being. That medical officers have administrative ability has been amply demonstrated by such officers as Wood, Hoff, Woodruff, and many others whose executive ability is only equaled by their medical record; that they have bravery, fortitude and endurance was amply shown in the Spanish-American war, and is now being shown daily in the Philippines. These are but types of the military surgeon; there are many others who did not have the opportunity to show their ability, but when the time comes they will not fail.

It is unnecessary for us to go into the details for the establishment and maintenance of a guard-line; it is a subject with which you are familiar. The sanitary cordon is conducted in the usual manner of a guard-line in the face of an enemy. The sentry should be able to see the entire length of his post, and the distance that he has to cover should never be so great that he can not reach any part of it in time to prevent its being crossed. At night the entire line should be lighted, if necessary, to prevent its being violated. For this purpose arc electric lights are most effective, but if not available, lanterns placed at short intervals may be used. If necessary, a barbed wire fence may be used where there is much tendency to break through the guard-line. It need only be used at those points where the danger is great. The medical officer commanding should keep himself constantly informed in regard to the conditions in his

territory. He should make frequent personal inspections of every part of it, and require written reports at stated intervals from officers in charge of the different divisions. The officer in charge of each relief of the guard should make a report of every incident of note that has occurred during his tour. In inspecting the inspector should not enter any section of the camp, but, standing at a safe distance, receive the verbal report of the officer in charge of each section, which should be taken down in writing. The daily reports should be received in the same manner.

The following form of organization is frequently used by the Marine Hospital Service in its epidemic work, and may be taken as a guide: (Additional officers are detailed for special work as required.) A commanding officer in charge of the work; one or more assistants; the following divisions, each in charge of a medical officer: 1. Contagious Disease Camp. 2. Suspect Camp. 3. Observation Camp. 4. Guard. 5. Inspectors. 6. Disinfecting Corps. 7. Train Inspection Service. 8. Transportation.

Each of these divisions is organized by the officer in charge of it, and who is held responsible for its work. He reports daily to the commanding officer and receives his instructions. The commanding officer keeps in close touch with the Surgeon-General, receiving his instructions and making frequent reports by letter and telegraph. He is given a good deal of latitude by the Surgeon-General, because he is an experienced officer, and being on the ground is best able to determine what is needed. He has authority over all other officers in his territory, and has the power to issue orders and to make necessary expenditures. He is in command of all the forces of the Service at that point. This form of organization is very mobile, and can be expanded or contracted as needed without interfering with the general plan. It has proved satisfactory and effective in the Marine Hospital Service, and I now offer it to you for your consideration.

DISCUSSION ON PAPER OF SURGEON C. P. WERTENBAKER.

Major C. C. Foster, Mass.—I was particularly interested in what was said about the plague. I saw the plague in Hong Kong in 1896 and when I returned home I prophesied that it would come to San Francisco sooner or later. The plague, after leaving Hong Kong, traveled in one direction constantly and it took four years for it to travel eastward toward the

Philippines. White men are not so susceptible to the plague as a rule. The only British soldiers affected in 1896 were those who volunteered to clean up the city as the Chinese refused to do so. The Pasteur Institute was just getting ready its first batch of Yersin serum at that time and they sent it to Hong Kong. The medical officers did not seem to have much confidence in the serum and consequently did not give it much of a trial. The pulmonary form of the plague was not recognized in 1896, the ordinary bubonic form being the only one recognized.

XIII. GENERAL HOSPITALS.

BY

LIEUT.-COL. ALFRED A. WOODHULL.

DEPUTY SURGEON-GENERAL, U. S. ARMY.

The medical officer assigned to a General Hospital finds nothing in relation to his duty in the Army Regulations or in the Manual for the Medical Department. He learns by A. R. 1433 that such hospitals are under the exclusive control of the Surgeon-General, and that the commander of a territorial department is the only other officer who can exercise authority over him. The practical effect of there being nowhere any specific instructions for the internal management of such commands has not only surprised but embarrassed some officers upon whom these responsibilities have been placed suddenly. The inevitable tendency to paternal contralization fostered by a long peace, and the miniature scale upon which our military forces were arranged prior to 1898, discouraged subordinate officers from theoretical study of such subjects, and gave no opportunity for their practical illustration except under the special and limited conditions of the General Hospital at Hot Springs, Arkansas. That object lesson could only be available for one or two officers within a considerable term of years. When hostilities with Spain began, the memories of the Civil War remained with very few and its traditions had not been cultivated. The last chapter of The Medical History of the War of the Rebellion, by Major (now Lt.-Col.) Smart, published in 1888, is an excellent general account of types of those hospitals chiefly as to their construction, showing their general development and explaining some of their requirements and usages. But it does not supply such a succinct description of their management as would guide an inexperienced officer in opening or successfully conducting a new general hospital.

Neither have those parts of it which would be of assistance had official attention drawn to them, nor has any of it been arranged for general circulation. It has been commonly regarded as of historical rather than of current value. The officer charged with such duty at the beginning of the Spanish War was therefore thrown entirely upon his own resources, excepting so far as his experience in a post hospital, whose analogy is very imperfect, might serve.

Hospitals that belong to posts, regiments, brigades, or divisions are subordinate parts of those organizations, exist for them, and may receive orders from their commanding officers. A general hospital draws its patients, its working staff, and its supplies from exterior sources and is independent of local control. In a military point of view it is an independent post, which doubtless is the reason why the regulations are silent about its interior affairs.

The organization and management of a post are learned by observation, experience and a knowledge of that system of common law that is called the customs of the service. These vary with circumstances, but the underlying principles do not change; and the medical or other officer who assumes that a general hospital is essentially a civil institution for whose conduct a doctor, a nurse, and a medicine case are all that are necessary, by so much displays ignorance and corresponding unfitness. As an independent post it reports at the most to the department commander, through his medical representative; and even that remote over-lordship may be suspended, as was done in 1898, and the hospital may report to the War Department direct. Further, besides being independent of external direction or interference, it is a more complex and difficult organization to control and the responsibility involved is far greater than that of an ordinary garrison, except in the rare case where the latter is directly involved in active military operations.

A general hospital implies a large number of sick soldiers detached from their organizations and thus beyond the usual machinery of control and supply. Their health will range from complete helplessness to advanced convalescence, and there will always be a few who have entirely recovered and are awaiting return to duty. The latter and the walking cases of local disease and of slight wounds, and the convalescents who are regaining their strength on full diet, are sometimes troublesome. Separated from their companions, newly raised men frequently assert an insubordinate independence. Trained troops properly looked after, less easily abandon their acquired habits; but all these, of both classes, must be controlled as well as treated. Besides the professional skill for their restoration to health or for their proper disposition, knowledge and an intelligence that is more than knowledge are necessary to keep them from irregularities that will bring reproach upon the medical department. The men in a general hospital must be clothed, subsisted and comfortably sheltered. Arrangements must be made for their payment and for their transportation, for the elimination of some from the service, for the burial of others, for the return of the majority to their

scattered commands or their transfer to other hospitals. All must be accounted for, in the military sense. They are to be fed both as soldiers and as patients. As invalids they are to be prescribed for and looked after, and as soldiers they are always to be under discipline in the sense of orderly care. When necessary, discipline in the more limited and punitive sense is to be enforced. In other words, a general hospital is administered for the welfare of the patients and in the interest of the Government. The medical officer's first concern is the restoration to health of those entrusted to him, but toward all within his jurisdiction he stands as a guardian, and especially toward the patients is he *in loco parentis* to protect and to enforce obedience. To fulfill this duty requires appreciation of the responsibility and knowledge for its discharge. It must be constantly before him, in all his waking hours. He must be as a captain in seeing to the details of the mess, of the clothing account, of the pay-roll with the necessary allowances and stoppages, and be responsible that the descriptive lists, the furloughs, the discharges and the final statements are correctly rendered, that the charges are made and the credits given. As the post commander he is further responsible from a higher plane that he himself or a subordinate has attended to these details, and that the various returns and requisitions are executed and acknowledged. The commanding officer of a general hospital has none of the ordinary administrative machinery of a post at his disposal, but must create it all and constantly supervise its work.

Within these limits it is impossible to describe the hospital itself; the various buildings, as reference is made to them, must be assumed to exist. Besides the commanding officer, there are required an executive officer or adjutant, and in very large hospitals a second officer may well be assigned to such duty; a quartermaster who would also be the commissary of subsistence; at least one chaplain; a chief operating surgeon; a pathologist who should also be a chemist; and a sufficient number of ward medical officers. Pressure may compel the operator and the pathologist to do ward work in addition to their special duties; but this is to be avoided if possible, and when the volume of such special work is great, each should have a permanent assistant. An alternate operating surgeon should be designated, so that in an emergency there may be no delay. In hospitals where there are many surgical cases there should be multiple operating rooms and a staff for each. Ward officers should be detailed by roster for limited periods as junior assistants in the operating rooms, that they may acquire experience and that those with surgical aptitude may be discovered. A specified officer should

be charged with the constant readiness of each operating room and its contents, and one or more of the Hospital Corps should be permanently assigned to the care of the instruments and appliances. But the officer, not the soldier, is responsible for their condition. Where surgical cases are infrequent, there would be corresponding modifications, but at every hospital there must be undivided surgical responsibility on some one's part. One officer selected for aptitude should be in charge of the full and light diet messes. This may or may not be in addition to ward work.

The larger the hospital the more difficult is the professional supervision, and some of this the commanding officer must delegate. The most convenient method is to create divisions of three or four wards each and assign to each division an officer of experience who would stand in the nature of a consultant to the ward officers and be responsible that there is neither neglect nor serious error. He should also exercise disciplinary supervision so far as to caution inexperienced officers concerning ward police and order. It would be better that the division officer should not himself be a ward officer, but the staff is rarely large enough to afford such additions. The efficient operation of this scheme depends upon the personal equation of the division officers. When they lack administrative judgment their influence is destroyed and their functions would better be omitted. The commanding officer should always be looked upon as a professional consultant, and where there are no division officers one or more consulting physicians also may properly be designated for advice in obscure or very serious cases. These would be selected by the commanding officer from the staff at large.

The ward officers, the most of whom would be civil physicians under contract, are the working staff upon whom directly rests the professional efficiency of the hospital. With the habits of civil life upon them, they often have difficulty in assuming the other duties that go with ward control in a military hospital; and however capable they may be individually, they must yield some of their personal independence in adapting themselves to the necessary routine, and especially in recognizing that the commanding officer has a higher responsibility to which their own is subordinate. It is when he can happily inspire them with a sense of cordial loyalty and co-operation, so that they frankly work together for the common good and maintain a generous rivalry that does not degenerate into unworthy competition, that the best results are found. They are to be treated with the utmost courtesy and respect, but this should not interfere with advice or admonition or with instruction and reproof as may be necessary, administered either collectively or

otherwise. Except under emergency, all interviews of this kind should occur in the privacy of the commanding officer's office and not publicly. If, unfortunately, there should be a tendency to irregular conduct on the part of any officer, immediate notice, kindly and lenient if possible, but plain and positive, is the only course. A commanding officer should not observe all that he sees nor listen to all that he hears, but he must be decided as well as judicious when he acts and no serious dereliction should be overlooked. Grave offenses cannot be condoned without risking their repetition. Merely as a matter of policy, it is easier to check irregularities impartially at the beginning.

The ward officers are ordinarily responsible for everything that occurs within their wards. Their first and chief duty is the professional care of the sick, but they must also see that order and cleanliness are maintained, that the ward records are properly kept, and that public property is not wasted. Officers' call should be sounded at a reasonably early hour, say not later than 8:30 A. M., when rounds should begin. Uniformity is necessary in this as in every other general function. It is discretionary with the ward officer whether he shall see every patient in regular order or the lighter cases first that they may be dismissed, but every patient must be seen at least every morning. Evening rounds must also be held daily within certain hours. With the consent of the division officer or, if there be none, of the commanding officer, the evening service may occasionally be delegated, and convalescents may be excused by the ward officer from attendance at evening rounds; but all bed-cases must be carefully observed at least twice daily. The ward officer must be accompanied by the soldier or the female nurse in charge of the particular patient, his directions must be reduced to writing by himself or by the attendant or nurse, and before he leaves the ward these must be signed by him as evidence that he has read them and they have been correctly noted. This particular rule is sometimes regarded as onerous, but experience shows that its neglect may be followed by error and by questions of fact and responsibility.

Patients are only to be transferred to other wards, and of course may only leave the hospital, by authority from the executive office. The death of a patient is to be immediately verified by the ward officer or the officer of the day, after which the body should be removed promptly and with as little publicity as possible to the morgue. At the same time the cot and the bedding used by the deceased are to be removed for appropriate cleansing without the ward. It is the ward officer's duty to assume charge of the effects of deceased patients and to pre-

pare the inventory required by A. R. 158. This should be done without delay to avoid the loss that may otherwise occur. These effects should be stored separately from those in the general property room.

The Executive Officer should be selected for his intelligence and acquaintance with methods of administration. He is charged with all those duties, so far as they pertain to a hospital, that ordinarily devolve upon a post adjutant. He has the oversight of all the routine papers of the hospital and is responsible for the correctness of the consolidated morning report, and particularly that it agrees with the admissions and departures as shown in the clerk's office. He signs all passes and the ordinary and routine papers connected with the internal administration of the hospital, and is responsible that the formal papers to which the commanding officer's signature is required are correctly and promptly prepared. He attends to the enforcement of the standing orders within the hospitals, acting for such purposes as a permanent inspector, and assists the commanding officer to see that the daily work of the hospital is systematically carried out, and he may properly conduct a large part of the correspondence that grows up with the families of sick or deceased soldiers. But, as in the case of garrisoned posts, military correspondence with those not belonging to the command should be signed by the commanding officer. Where this is a mere letter of transmittal or of acknowledgment it may be authenticated by a fac simile. It is particularly the duty of the executive officer to see that patients transferred as such are properly provided for and conveyed; and he should also inspect the men returned to quarters or to duty, to see that they have all their property and that they leave the hospital at an appropriate time and in a proper way. In a very large hospital these duties may be divided between two executives, for it is important that neither the commanding officer nor this assistant should be entirely confined to office work.

An officer of the day and an alternate should be appointed by roster day by day, and they should be notified in writing in the usual manner before noon of the day preceding that on which they shall be for duty. The alternate is the officer who would ordinarily succeed the officer of the day. During his tour an alternate officer must not leave the hospital grounds, and in the event of the officer of the day becoming incapacitated, he immediately assumes that duty for the remainder of the tour. The discharge by an alternate of any part of the officer of the day's tour counts as a tour for the alternate, and he does not go on duty again until his tour comes around anew. In the event

of the alternate going on as officer of the day, the executive officer immediately warns the next on the roster that he may report for duty the succeeding day. The old officer of the day and the new officer of the day report together to the commanding officer in his office exactly at the fixed hour, which should by preference be 8 A. M. All of these must be in appropriate uniform and cultivate a proper bearing, and the officer of the day should be recognized by some special feature of uniform, as, for instance, wearing white gloves, except when so engaged that it would be unsuitable. The old officer of the day upon being relieved, will state any unusual incident that has occurred, and the new officer of the day receives such special instructions as the commanding officer may have to give. Immediately thereafter the old officer of the day should submit in writing, according to a fixed schedule, a report of the events of his tour and especially will note such conditions as he thinks require amendment.

There should be set apart for the officer of the day an appropriate and accessible room not otherwise occupied, which should contain a bed and other appropriate furniture, and when not engaged upon his duties or at his meals he is to remain therein. At night he should not remove more of his clothing than his coat, so as always to respond immediately to a call.

Three soldiers should be detailed as permanent orderlies for the officer of the day, to go on duty on successive days. When on day duty the orderly shall be distinguished in some way that he may be readily known. At night he should always be near the officer of the day's door, unless sent away on duty by him. At night a light should always burn in the officer of the day's room and a lighted lantern be in charge of the orderly.

The officer of the day receives the roll-calls at reveille and retreat. He inspects at least one full-diet and one light-diet meal each day, which may or may not be designated by the commanding officer. During the day he must visit every part of the grounds and all the occupied buildings, except the interior of the officers' quarters and that of the nurses', and inspect them for cleanliness and order. He should observe and when possible correct at the time all violations of police, he must inspect all water-closets and sinks, except those of the quarters just mentioned, and note their condition, and particularly inspect the hospital kitchens, the operating rooms, the dispensary, the laundry, the disinfecting apparatus, the garbage furnace, the morgue, the stables, the servants' quarters, the Hospital Corps barracks, and the guard-house. If he is not a commissioned

officer and acting under instructions as such, he should not attempt to inspect the guard. The Hospital Corps barracks are to be inspected for cleanliness and order. The barracks of the guard and the guard-house are to be inspected for sanitation. The hospital ambulance should be inspected for cleanliness and for serviceability as early in the day as practicable, preferably at a fixed hour. The officer of the day must visit every ward at least once in the day-time and once between midnight and daylight to observe that the attendants are alert, to correct any irregularity that may be noticed, to receive any report that may be offered, and to render any help that may be asked. He should not interfere with the standing rules or recognized custom of a ward, but if he thinks it expedient, may invite the commanding officer's attention orally to any condition observed. He must, further, be available to answer any emergency call between 8 P. M. and 7 A. M. from any ward, and the ward attendants are to be instructed to call upon the officer of the day in case of need rather than to send at night for the ward officer, unless especially directed by the latter thus to do. But should the officer of the day think that the ward officer ought also see a case to which he has been called, he should send for him at once. This arrangement whereby the ward officers may be reasonably secure from night calls affords them great relief and, although adding to the officer of the day's responsibility, it distributes that burden over considerable intervals of time and always secures the prompt attendance of a responsible official. The executive officer and, ordinarily, field medical officers would not be on the roster for officer of the day, but it is within the province of the commanding officer to require this duty of the latter.

A list of vacant beds in each ward is to be obtained from the executive officer by the new officer of the day, who should distribute the incoming patients among them. This is to be done after personal inspection if possible; but in anticipation of hours when he may be otherwise occupied, he should leave directions at the main entrance for the assignment of incoming patients, after which he should confirm the distribution as soon as possible. He must see that such arms and ammunition as accompany patients are properly tagged, stored and receipted for without passing into the wards. The duties of the officer of the day as thus outlined will occupy nearly the entire time of an energetic man, but they all are necessary and their efficient discharge will materially aid the administration of the hospital.

One medical officer to be designated by roster every one or two months should hold surgeon's call for the Hospital Corps

and also the civil employés. This service should be discharged early in the morning before the other routine medical work begins. The sick book must be promptly turned in to the clerk's office with the detachment morning report for use with the consolidated morning report, and all men excused from duty on the detachment sick book must be taken up on the register. Excepting such light cases as would be designated for quarters if in garrison, all the sick of the detachment should be treated in the wards. The same officer who takes sick call should see emergency cases in the detachment.

An officer to be selected for his special qualifications should be in immediate command of the Hospital Corps detachment, and be responsible for its bearing and interior discipline, for its care and for that of its official records. He should keep an independent register of the duties each man performs and make a weekly entry of his efficiency as known to him or as reported by the officer under whom the soldier serves. The immediate detachment commander may or may not be the executive officer, as the commanding officer may determine. Their military status should at all times be impressed upon the Hospital Corps soldiers, for it is chiefly by the cultivation of such *esprit* that they become efficient in their special duties. Besides their ordinary duty, attendance must be required of these noncommissioned officers and men in schools of instruction where they shall receive theoretical and practical teaching in all branches of their duty, including drill. The claim is frequently made that this must be inferior to the practical work done in the wards. That is an error. The ward work and all other duty will be better done if the methods and underlying reasons are taught. This instruction should be given five days in the week for short periods at a time, half an hour being usually enough, so arranged that those on duty may conveniently attend. Notwithstanding the remonstrance that some men cannot be spared from the ward, the office, or other special work, a little ingenuity and zeal will usually find a way to secure the presence at one time or the other in the course of the day of nearly every one. To accomplish that, different squads may require to assemble at different hours. Recruits and other uninstructed men will require longer and repeated lessons, and men noted as proficient in any special branch may be excused from other than occasional, but regular, attendance thereon. Careful instruction makes the men more interested and the service more efficient. That part of the detachment, whether small or large, not engaged in special work, should attend roll call at reveille and retreat, which should be received by the officer of the day. The presence at taps of

all the men belonging to the barracks and on other duty should be verified, and checks may properly be held. It is generally good administration to yield every reasonable indulgence to the man, but unauthorized absence and all minor neglects should be officially noticed. It is soon learned that firmness and evenness of administration are not severity, and it is satisfactory to all to feel constantly that impartial order, and not indifference or uneven pressure, is the rule.

The personnel of a ward consists of a wardmaster, two or more privates of the hospital corps conveniently known as attendants, and one or two trained female nurses. A head nurse, as known in civil hospitals, is out of place here. Under special conditions one or more civil laborers may be attached when there is much work not immediately connected with the care of the sick, but as a rule the men of the Hospital Corps should be sufficient for all ward purposes. The wardmaster should be a non-commissioned officer, or when such is unattainable, an experienced and trustworthy private. He should be responsible for the discipline of both patients and attendants, for the cleanliness of the ward and everything in it, for the care and proper use of the hospital property and for the safe keeping of such private property as the patients are allowed to have with them. The safety of public property can only be assured by the use of memorandum books and constant and vigilant inspection by this non-commissioned officer. There is an almost uncontrollable tendency among raw men and departing patients to throw away damaged property or to carry off portable articles. It is to the wardmaster that the ward surgeon should look in the first place for explanation in all matters, excepting where special instructions have been given as to treatment. These special instructions need not necessarily pass through him, but they should do so if in any way they interfere with the daily routine. The wardmaster sees that the special diets required are brought at the proper time, that the men who go to the mess-hall are conducted promptly and in order, and he rectifies any irregularity on the spot or refers it to his superior. He verifies the presence of all the patients at the stated hours and reports them present or enters the names of the absentees on the ward morning report. The Hospital Corps privates, or attendants, keep the wards and all that they contain in order under the wardmaster's direction. They wash the windows, make the fires, scrub the floors, keep the furniture neat, keep the wash rooms, the bath-tubs, and the closets in order, make the beds of those patients unable to do this for themselves, take the temperatures, administer the medicines, note the physical phenomena, and in general terms care

for the sick as the ward officer may require. The female nurses when present, may relieve the Hospital Corps men of the immediate care of designated sick, but they are not to be regarded as in charge of the ward nor are the soldiers to be referred to or looked upon as their subordinates or assistants. Women nurses whose hospital experience has been limited to civil hospitals, tend to regard the Hospital Corps soldiers as their orderlies, to employ them only in the rougher work, and to monopolize for themselves the entire care of the sick regardless of the gravity of the case. That is a misapprehension, the effect of which is to limit the efficiency of the Hospital Corps and to lead to friction. The place of the female nurse is not one of authority, except as toward her particular patient. She is a substitute for the male attendant, either as entirely caring for some or in dividing with the soldier the care of others. Both the nurse and the attendant are subordinate to the wardmaster, and the ward officer is responsible for the general conduct of the ward. But a judicious nurse will rarely appeal to the wardmaster as against an attendant or a patient, and a wise wardmaster will not interfere directly with a nurse, except when she is palpably and persistently in the wrong and the ward officer is inaccessible. It is an error to suppose that because a female nurse is attached to a ward, therefore she is to concern herself with every case in it. Selected cases should be assigned to her. Speaking generally, the presence of women is annoying or embarrassing to convalescent patients, and their usefulness is greatest with those that are helpless. Hence, in certain wards there should be no women. The men of the Hospital Corps are not to be looked upon or designated as the servants of the patients. This would appear a superfluous injunction had I not heard a volunteer medical officer acting as a summary court thus style a ward attendant. They are to be impressed with a sense of authority for preserving order, and with the dignity of rendering to the sick assistance similar except in degree to that given by the medical officer himself. Every patient as he is able should be required to care for his own bed and for the adjacent part of the ward, and especially to correct any disorder that he may have caused. It is comparatively easy to establish a public opinion that makes for system and cleanliness, and it is interesting to note how quickly newly-arrived groups of patients will fall into a well-ordered routine. The ward as a whole must be responsible for its environs as well as for its interior, else there is an invitation merely to eject refuse that is not tolerated within doors.

One of the most annoying administrative problems is the

care of patients' personal property. Some will be received with nothing but the clothes they are wearing and such valuables as may be in their pockets, and others are loaded down with all manner of things often badly secured. The simplest solution is the use of the duplicate pasteboard special baggage check and shell, the checks to bear corresponding numbers. One check is to be given to the soldier, and the other with the shell to be attached to the property. For greater security the man's name and command should also be inscribed on each check. But where very ill men are received, especially in considerable numbers, it is difficult to check their property correctly. Under any circumstances, an intelligent and perfectly trustworthy storekeeper must be detailed, and the checked packages be arranged systematically. When convalescents are allowed to visit the store-room, or their property is sent for, great care is to be taken that they only receive their own, and should there be any doubt, the identification must be complete. This method does not provide for a record of every article, and there is always an opportunity for unfounded claims to be made. The English system of making a duplicate entry in a book and giving the soldier a list to which another on the stub corresponds, is too elaborate. There is also risk of money and trinkets being lost in a large ward, and every man on admission should be carefully warned by the wardmaster and again by the ward officer that there is a safe in the commanding officer's office expressly to care for such valuables. If he is not of clear mind, his money and watch should be transferred to the safe regardless of his consent. The safe combination should be known only to the commanding officer and his executive, and men should be made to understand clearly that they may remove any part of the deposit at any time within specified hours. All deposits should be entered in a book or be noted upon the parcel in the presence of the depositor and the entry canceled in like manner on withdrawal, but it is not expedient to give detached receipts for money thus held. When patients are transferred, it is better to send the original parcels at the same time than to draw a check for the total amount to be distributed afterward.

When arms and equipment are brought to the hospital, as is frequently done by men coming from the front, the utmost pains should be taken to associate the soldier's name with the property, and the numbers and marks thereon should be carefully recorded. Public property of this kind is to be stored by itself and a competent man detailed to preserve it from rust or other damage and to keep the record. Should there be any other disposition of the soldier than a return to duty, the ord-

nance should be taken up by the ordnance officer of the hospital and the quartermaster's property by the quartermaster, be receipted for to the responsible officer, and finally be duly transferred. This question of public property is one of the most serious and vexing to the soldier, to the hospital authorities, and to the company officer. Arms or ammunition should never be sent away with the soldier, except when he goes to duty.

Two of the most difficult hospital records to maintain without error and two of the most important, are the morning report and the register, simple as they are in theory. The first is a numerical account of the number present at a stated hour each morning, showing the changes during the preceding twenty-four hours. The second is a nominal list of all the patients, including their designation, their disability, the source of admission and their disposition, with the necessary dates and other particulars. These records are checks upon each other and both are necessary to enable the strength of the hospital to be known at any particular time. Upon them depend the accuracy of the ration returns, the reports made to the War Department, and the military and hospital histories of the individual patients. The truthfulness of these records rests ultimately upon those kept in the wards. Every ward must furnish the executive officer each morning a numerical morning report accompanied by a Gain list and a Loss list. These are three separate documents, each signed by the wardmaster and confirmed by the ward officer, and should be complete over the whole hospital to a uniform hour. It is possible for all of these reports to be on one paper, but for working purposes they would better be distinct. The Gain list must give the name, designation, etc., of every patient admitted to the ward since the last report, specifying whence he was received, and this should show those transferred from other wards as well as the original admissions to the hospital. The Loss list must show all who have left the ward and their disposition. The Gain and the Loss lists together should account for all changes in the ward morning report, which should also show the number of vacant beds. Theoretically the sum of the Gain lists should correspond exactly with the number of the men transferred to the hospital, plus those moved from one ward to another, and in the case of hospitals receiving men only from a distance, the record is simple. But where the hospitals are near the troops, emergency as well as unauthorized admissions and departures may at any time disturb that reckoning. It is no unusual thing in a hospital of many hundred beds for sick men to straggle in without formal authority or for impatient convalescents to elope, to say nothing of temporary ab-

sences without leave. It is important therefore for the officer of the day to keep and transmit an independent list of admissions by wards, and where for any reason a patient is received without the direct authority of the officer of the day, the wardmaster must report the fact to him immediately. The wardmaster should verify by actual count the patients present at reveille every day. All of these reports pass at once into the hands of the chief clerk, who corresponds to the sergeant major. He must in the name of the executive officer investigate any discrepancy without delay and have the figures corrected. The Gain and Loss lists when proved to be correct, pass to the registry clerk by whom they are used in writing up the register, and care is necessary to see that the names are entered thereon in chronological order. The first use, however, to be made of the Gain and Loss lists after the consolidated morning report is prepared, is with the card register. For all practical purposes, except that it is not yet authorized as a substitute for the official book register, the card register is the most important and comprehensive document in the hospital. By it may be learned at a glance whether any particular man has been in the hospital at any time, whence he was admitted, the diagnosis, the ward or wards in which he was treated, and the disposition of the case. The cards should be about 3x5 inches, substantially as follows:

			Hosp. No..........	
Surname.		Christian name.		
....		....		
Regiment............	Co..................		Rank..................	
Whence received.	Hour.	Day.	Month.	Year.
....	....	....	....	....
Disposition..........	....	....	....	....
Diagnosis.....................................				
Ward....................				

These cards properly inscribed should be arranged alphabetically, each letter group being conspicuously indexed. Separate files should be maintained for regulars and volunteers. When a soldier's connection with the hospital ceases, his card is transferred from the "Present" to the "Past" file arranged in the same manner. When a man's name is known, it becomes but the work of an instant to determine all the essential facts about him. The diagnosis is to be entered when determined, with alter-

ations or complications following each other. When transfer within the hospital occurs, the number of the ward and the date are added in succession, so as to preserve the record of local residence.

A duplicate card register may be arranged by regiments and companies, to determine promptly the number of names of men of a particular command who are or have been in hospital. The regiments and the companies within the regiments should follow each other in the file in regular order, with the names placed alphabetically. All that would be absolutely necessary are the soldier's hospital number, his name and designation, the day of admission and the day and mode of disposition, and the diagnosis. Any other information would be obtainable from the principal register, to which reference is easy. It so frequently is desirable to select or to report at once the names or the number of men from particular commands, with the character of the disability, that this small additional labor is commended. As with the main or alphabetical register, when a man leaves the hospital his card should be transferred from the present to the past file. The form of the card, 3x5 inches, would be this:

		Hosp. No..........
Regiment.	Co.	Rank.
....	....	....
Surname.	Christian name.	
....	....	
Admission (date)......................		
Disposition (date and manner)....................................		
Diagnosis		

There are other forms for the collection and distribution of information that experience shows to be convenient in the administration of a large hospital, but it is not expedient to offer such here for exact imitation.

Next in importance to the actual care of the patients present is the selection of those to leave the hospital. Men frequently ask to be sent to duty who are utterly unfit, and others who are entirely well will employ every device to remain longer. It is much the better practice for a permanent examining board to pass upon all men recommended for duty, for furlough on account of sickness, and upon suspected malingerers, and on stated days, or whenever specially called upon, the ward officer should submit in writing the names of patients falling within

these classes. Whether these are thus treated or not, it is imperative that a board of experienced officers sitting once or twice a week should examine all cases recommended for discharge for disability. Speaking generally, this board should consist of five, of whom three would be a quorum. The commanding officer, as the senior medical officer present and also as the man's immediate commander, is required to sign both certificates of disability as well as to write out with his own hand the medical certificate. Without assistance he cannot examine all such cases critically. The man should therefore be sent before the board with a brief account of the presumed disability by the ward officer, and with any other papers bearing on the case. The board should carefully examine him and come to a finding, not only in regard to the presumed defect, but as to any other that may be suspected and the relation of its incurrence to duty. The findings and other papers should be submitted to the commanding officer. Each case should be reported separately and numbered consecutively. The report should be signed by the entire board, or be accompanied by a minority report in the case of dissenting members. These reports should be accurate, but not elaborate. With them as a guide, the commanding officer himself examines the man in relation to the disability as already found, and he is thus able to reach a conclusion promptly, and, if he confirms the action of the board, to prepare the certificate easily.

Ward lists, to be corrected weekly, of all men more than two months in hospital should be kept by the ward officers for reference when desired. In every case admitted with a transfer slip the diagnosis thereupon should be entered in the ward book. This is to be formally confirmed or corrected as promptly as consistent with accuracy, and the diagnosis and all changes and complications are to be reported in writing as soon as they are determined. When an autopsy is made, the post mortem diagnosis must also be entered on the register. When a death occurs, a report with a statement of the cause, in addition to the entry on the daily loss list, should be immediately made on a hospital form to the executive officer and the necessary steps should be taken by him for an autopsy if expedient and for the interment.

Company officers are justly annoyed when they receive no intimation of the transfer of their men once sent to a general hospital. Whenever a soldier's connection with a general hospital is severed, his company commander should be immediately notified. He should also be notified on the last day of every month of all men then present. These notices involve a great

deal of clerical labor and in the absence of printed forms are sometimes impracticable to effect. But a printed card with a stamped signature, to go through the mail without an envelope and leaving only the name to be filled in, simplifies the work and greatly assists in maintaining pleasant official relations. A form like this may be used:

(Place)........................
(Date)........................

The Commanding Officer,
Co..................... Rgt., ...
* Private......................................, of your company,
† was admitted to...........
† remained in..............
† went to duty from .... this hospital to-day.
† was furloughed from......
† was transferred to ....
.....................from

.........................,
.........................,
Cdg.

* Substitute the proper grade.
† Erase lines not used.
† Add destination.

Notices of death or discharge from the service must be more formal and detailed.

The clerical force of a general hospital increases in direct ratio with its capacity. The patients are detached from their proper commands and all the papers that show their relations with the supply departments, of which the descriptive list is the most important, must be prepared there. It is not sufficient, as sometimes is done, to endorse upon the original descriptive list the payments, the stoppages and the issues, and then transmit it to the man's next station. The old descriptive list should be filed for the officer's protection and a new one be prepared on the soldier's departure. Any other course involves risk to the officer, and should the original be lost in transit the soldier may suffer. These accounts are often complicated and always annoying in detail. The main dependence must be upon trustworthy clerks, but it is an officer's duty to see that gross errors do not occur. The supervision of the clothing issues and accounts must be given to junior officers. But over these, as over every part of hospital administration, the commanding officer's personal control must be felt, and he must be recognized everywhere, not obtrusively, but actually as command-

ing. The phrase "in charge" is a relic of the older civil administration, always to be discarded.

The questions of guard duty and fire protection, the relation of music, of reading and recreation rooms, of religious services, of mail facilities, of passes, are among other subjects to be dismissed without consideration here.

In general terms it may be said that the management of a general hospital is to be arranged so that all concerned may have as much comfort as a careful regard to the public service will permit, but whatever rules are established must be respected. For instance, ward officers may be given general permission to be absent after their morning or evening work is over, provided at least one to a division is present. The exception is where special work has been announced, and the condition is a prompt return for the next regular duty or the hour of midnight. Failure to comply should be met as would be the case with subalterns of the line. Hospital corps men off duty should have the same privileges as soldiers of the line off duty. Convalescents are to be encouraged to pass beyond the hospital when it may be safely done, but in both instances absence without leave or misconduct while absent is not to be overlooked.

The relation of the female nurses, when not on duty, to the personnel of the hospital is a delicate problem. My present conviction is that no social intercourse should be allowed between them, the chief of nurses excepted, and the medical officers either within or beyond the hospital limits. The ultimate effect will be the subversion of discipline, as certainly as if the officers and enlisted men associated under similar conditions. Nor should the nurses and the patients or the detachment meet on a social equality within the hospital grounds, and such association while on pass should not be encouraged.

Finally, to regulate the relation of organized or unorganized benevolence to general hospitals is a very delicate matter. When a military hospital is situated near a town, curiosity and interest impel numerous people, who would not expect or be allowed to roam through soldiers' barracks, to invade the hospital wards. Many of those who intrude upon the privacy of the soldier sick would at once resent a corresponding invasion of their own sick rooms. While absolute exclusion is neither desirable nor practicable, hours for general visiting must be established and adhered to and violation of hospital rules be met with a denial of further privileges. A universal exception is in the case of the actual relatives of particular patients, who should be given free access to them when this can be done

without harm. Visitors to the sick from a distance should always be considerately treated. But the practice of making hospital wards a place of resort for gratification of curiosity or the display of impersonal and general interest should be discouraged.

I believe it is proper voluntarily to notify the immediate family of a patient when his illness is serious. This may be done by a brief printed notice and such action will frequently afford much comfort to the family, and will add to their confidence in the hospital management and to their kindly feeling toward it. Something as follows will usually answer the purpose:

```
                                        (Place)........................
                                          (Date)........................
To
    ..........  ....................
         ...............................
    Private................................, Co......................
Regt...............................is seriously ill in this hospital with
.................. ............ A fatal result is not* now anticipated,
but you will be advised of any material change.
                              Respectfully,
                                        ............................
                                          ............................
                                                  Executive Officer.
*Erase if not needed.
```

All correspondence concerning patients should be conducted through the executive officer or by the commanding officer.

Whenever the address is known, the family of a deceased soldier dying in the United States should be immediately advised thereof, and while orders, as at present, allow the transportation of the body at public expense, inquiry should be made as to its disposal. This notice and inquiry should be by telegraph. In this connection consult A. R., 803.

In time of war charitable organizations are disposed to press money and supplies in kind upon general hospitals. There is rarely occasion to accept such after the hospital organization has been completed, and the lavishness with which such gifts are offered tends to diminish the sense of official responsibility and leads to reliance upon private charities that at any time may fail. The men receive in charity what is their official right and their self-respect is liable to be weakened. Money for the use of particular organizations or for men from special localities should never be accepted. No distinction may properly be drawn between United States soldiers when once mustered into the Federal service, except that founded upon their disabilities and their needs.

XIV. THE SPANISH-AMERICAN WAR AS SEEN BY THE MILITARY SURGEON.

BY

MAJOR ALLEN A. WESLEY, M. D.,

LATE SURGEON U. S. V. I.

GENTLEMEN:—If I gladly welcomed the opportunity of appearing before the Illinois Association of Military Surgeons (presided over as it is by one of the most deservedly distinguished surgeons of the country, Colonel Nicholas Senn), I could not be less than profoundly grateful for my generous introduction to the Association of Military Surgeons of the United States by our gifted President and Assistant-Surgeon General U. S. A., Colonel C. H. Alden. Nor shall I ever recall with aught but the deepest gratitude the favor here accorded me by the Literary Committee so ably represented by General Calef—the privilege of presenting to this eminent body some of the experiences which I had in the Spanish-American War, while serving as Major and Surgeon of the Eighth Illinois Volunteers, the only negro regiment in the service which was officered by men of that race.

Our position being unique, I may be pardoned for referring to our condition prior to the call to arms. At that time the negro in Illinois had his only source of military training in the State militia. As a single battalion, since 1891 he had been a part of the National Guard. Here he learned the regulation drill and the duties of a soldier; here he learned to obey and be obeyed; here he learned the bugle-calls, "reveille," "tattoo," "assembly," and "taps." Observation, however, leads me to believe that he knew "mess call" from earliest infancy, and that, in this respect at least, he is a "born soldier."

When diplomatic relations with Spain were severed—when the hand of Time again had opened the purple testament of bleeding war—every man of our battalion, like a racehorse at the post, anxiously awaited the signal to go. But the War Department's first call did not permit us to do so, as the State's quota was not sufficiently large. You can never know the chagrin, the discouragement and the sorrow which the members of our battalion felt when they saw their comrades march away, while they were left behind. Then came, as a solace to me, Milton's words—

"They also serve who only stand and wait."

But it was a difficult task to make the "boys" believe the quotation true as applied to themselves.

At this juncture Governor Tanner came to our rescue. He believed there would be another call for troops, and in that event he promised us permission to recruit as a regiment, and said he would give us a chance to win our laurels by allowing us to have officers of our race. In May a second call for troops was made. The Governor's first duty was to recruit sufficient men to bring each company of the existing Illinois regiments up to the new requirement of 106 men. This being done, it was found the State was still entitled to two regiments. Anticipating this, Governor Tanner had ordered a preliminary physical examination of the recruits, in order to avoid taking unfit men to Springfield. Drs. D. H. Williams, J. R. White, J. N. Croker, E. S. Miller and myself did this work. Most of the rejections were on account of hernia, prolapse of the rectum, and tachycardia. Twenty-four hours after the Governor issued his second call, the Eighth and Ninth Regiments were in Camp Tanner at Springfield.

The candidates who successfully passed the examination given by the Medical Board were assigned in this way:

Eighth Infantry—Surgeon, A. A. Wesley. Assistant Surgeons, E. S. Miller and J. W. Curtis.

Ninth Infantry—Surgeon, Andy Hall. Assistant Surgeons, W. R. Washburn and W. G. Gregory.

The surgeons assigned to these regiments now formed the Medical Board which gave the recruits their final examination. The men of the Ninth were examined first; the southern part of the State had sent up some beautiful specimens of physical development, and the rejections were very few. The Eighth also had some fine physiques. One company boasted that it did not have a man less than six feet in height, and five feet six or eight inches was the rule throughout. Broad chests, strong hearts and powerful muscles were these men's inheritance.

While at Springfield the most important diseases with which we were engaged were rubeola and pneumonia. The measles was brought to us by the company from Cairo, Ill., where the disease was then prevailing. These cases were placed in isolated tents, and after recovery were bathed and oiled before being sent to their quarters. The disease was thus stamped out. We had several cases of pneumonia, the most severe of which—through the courtesy of Col. G. N. Kreider—were placed in St. John's Hospital, where they made a speedy recovery under the cold treatment.

Col. J. R. Marshall was sworn in July 23, and Illinois stood as the pioneer State in giving the black man the right to do and die for his country with "straps" on his shoulders. During the brief interval when we were neither in State nor Government service, Governor Tanner proved his friendship by doing much to make both regiments comfortable. Mrs. Tanner also daily visited the hospitals, and from her own purse made many purchases for the sick.

Hospital Corps.—I selected two suitable men from each company of the Eighth and had them detailed for special hospital duty. This gave me twenty-four men for my corps, aside from the three hospital stewards. I retained this system throughout the campaign, increasing the quota when necessary.

Cause of Going to the Front.—The immediate cause of our going to the front was the fact that the drenching diurnal rains and the dreadful Cuban fevers had begun to decimate the ranks of all the United States forces located in and around Santiago. Among these were the brave boys of the First Illinois Volunteers, to relieve whom Governor Tanner suggested that the Eighth Illinois be sent, and he requested Colonel Marshall to get from the regiment an expression on this point. Every man said: "I will go." The War Department then ordered us to leave Springfield for New York, there to embark for Cuba on the transport Yale.

Amid the rejoicing and excitement I applied to the mustering officer, Major Ballou, for medicines. His instructions from Washington were that it would be unnecessary to purchase any medicines in Springfield, as I would be furnished ample supplies in New York. I stated that I did not wish to be responsible for moving 1,300 men without medicines, and that if he would give me a letter relieving me of such responsibility, I would be satisfied. Instead of giving me a letter, however, he O. K.'d a requisition which I made. Thus was furnished the only medicine we had until we arrived in Cuba.

Off to War.—We left Springfield August 8, 1898, in four sections. So great was the desire to go to war that nineteen men followed us to Cuba and enlisted there. On our journey to New York, while one of the rear sections was passing over a trestle, a private (celebrating the fact that we were going to war) fell off the train and into a ravine. As the following section was passing over the trestle the soldier was seen below, lying on the ground, which fact was reported to Major F. A. Denison, in command. He ordered the train backed up to get the remains. Four men were sent to bring up the body. As they were about to lift it up, to their surprise they discovered

that the soldier was only asleep. On examination it was found that he had merely sustained a few scratches about the body, and a slightly sprained ankle.

Arrival in New York.—After our arrival in New York I boarded the Yale as soon as possible, and found no person who could say more than that he knew that the supplies for the Eighth had been put aboard—but where? Here was a boat one-tenth of a mile long, and when one started down the hold it suggested a trip on an elevator of a Chicago building from the sixteenth story to the ground floor. It so happened that the quartermaster supplies, commissary supplies and medical supplies for the army in Cuba—as well as supplies for the Eighth Illinois, the rations for fifty-one male nurses, and the regular provisions for the passengers and the crew—were on this boat. Looking for anything in one of the holds was like searching Pandora's box—all blessings gone but hope.

Shortly after boarding ship several telegrams came from Washington, asking if I had received the medical chests sent me. Inquiry revealed nothing but a general impression that they had been put aboard, and I answered the messages accordingly. In the mean time Lieutenant White, of the Seventh Illinois, had placed in my charge a number of immune male nurses going to Santiago to attend the yellow fever patients. In two and a half hours after boarding the Yale we were out in the stream. During this short time I had to dispose of my sick both ashore and aboard. I had to go to a telegraph office, find my supplies if possible, look after the fifty-one male nurses before alluded to, and perform other immediate duties. Had it not been for the Chief of Police, who sent me ambulances, some of my sick would have been left on the wharf. It seems to me that some officer of the Government should have superintended the loading of all supplies—retaining a diagram or memorandum of what each hold contained—and that such responsible officer should have met us at the boat, prepared to give us any desired or necessary information. As it was, my supplies were not found for several days after we reached Cuba, and one medical chest we never received. We had only what medicines I managed to bring with me from Springfield. The rations for the fifty-one male nurses were never found, and I made arrangements with the steward for their food. All things considered, I fully realized that the Government was ill-prepared for war from the standpoint of transport service. The Yale (formerly the City of Paris) was a magnificent passenger carrier, but a very poor transport, as the deck was the only place for the soldiers, no matter what the weather might

be. There was no proper place for hospital, drug-room, or "sick call." I believe every transport should have these three accommodations, each of ample capacity, aside from all arrangements for the crew of the vessel. I do not make these statements in a spirit of criticism—for who could have done better than Surgeon-General Sternberg?—but my purpose is to show, as far as my limited experience permits, where possibly the volunteer service could be improved. This should be studied, because the volunteer army has been, is now, and always will be a necessity in a republican form of government; for whenever a republic, needing defense, is unable to summon volunteers from its citizens, it is doomed to destruction. I recognize the fact, however, that to have properly equipped and taken care of 250,000 men in the short time then at the disposal of the Government, would have almost taxed the powers of the Omniscient.

Arrival in Cuba.—On August 15 we steamed into beautiful Guantanamo Bay, and passed the spot where fell John Blair Gibbs, the first American medical officer shot and killed in the Spanish-American War. Here we learned that the blockade had been raised, and that hostilities had ceased. With this information the dream of the surgeon vanished. Only the night before in slumber he had been surrounded by many patients, the different cavities and structures of whose bodies had been pierced by Mauser bullets. In dreams he had been busy examining and recording the effects of these bullets on tissue and bone, and had been carefully inserting Senn's bone plates, or the Murphy button, or using Maunsell's invagination method of suturing the intestines. He was still dreaming; but with the words "The war is over" he awoke and realized that—

"There is never a dream of pleasure
But the waking makes us sad."

However, after awaking, it dawned upon him that medicine must take the place of surgery, and that if the regiment were to remain in Cuba for any length of time, the men would have to meet a more deadly and potential force than the Mauser bullet—that is, the yellow fever germ, reinforced by the cohorts of plasmodium malariæ.

After a short stay in the bay we steamed out along the coast, where the mountains rolled in successive ascending ridges until lost in the mists and the clouds. Those wrinkled hills, the silent monuments of Cuban valor, stood out in all their grandeur and seemed to welcome us. That evening we anchored off Morro Castle, and the next afternoon we landed at Santiago,

having passed the vessel upon which were the sick and convalescent of the First Illinois. When they learned that we were the Eighth, cheer after cheer broke over the bay, and the reverberating hills caught up the salutation, echoing and re-echoing the mutual greeting.

> " We cordially greeted each other,
> In the old, familiar tone;
> But I thought, though I did not say it,
> ' How pale and weak they have grown.' "

That night we camped upon a hill in what had been the court of a Spanish yellow fever hospital. I did not then know that the place had been thoroughly fumigated, nevertheless I concluded to " wrap the drapery of my couch about me and lie down to pleasant dreams." In this case the "drapery" consisted of a rain-coat, the " couch " of some hard-tack boxes, and the " dreams " of anything but comfort.

Before disembarking I had ordered Sergeant Rantus of F Company taken to the Nautical Club Hospital. Leaving Springfield as a malarial fever convalescent, he had done nicely on the voyage, but had arrived at Santiago in no condition to march and camp out. Next day he did well, but a few days later information came that he had the yellow fever and had been sent to the yellow fever hospital across the bay. Here he was refused admission on the ground that he did not have yellow fever, and was returned to the Nautical Club Hospital, and this time he was admitted—perhaps out of sympathy. The man recovered, did service, and came home with us.

This case illustrates that the medical profession (as represented at Santiago) differed as to what constituted a case of yellow fever. Some physicians seemed to rely wholly upon the presence of albumen in the urine, in connection with the symptoms of an intermittent fever. Others maintained that there was no such thing as yellow fever, and that all so-called yellow fever was malarial in origin. Still others there were who insisted that all Cuban fevers were yellow fever. And still another class claimed that these fevers were antithetical; that is, that malarial fever was a preventive of yellow fever, and vice versa. Such seemed to be the status of medical opinion concerning yellow fever upon my arrival.

On the morning of August 17, as I was on the way to the " Palace," I heard a man shouting " Loose ! " " Loose ! " in the street. Astonished, I turned to inquire what was the matter, and then for the first time felt what it meant to be in a country whose people speak a language that differs from one's own. I

afterward learned that the man had oil for sale, and was shouting the Spanish word "luz," meaning light.

Arriving at the Palace, or Headquarters, I reported to the Chief Surgeon, Col. Valery Havard, U. S. A., a very superior man. In the midst of a great rush he endorsed my requisition and took my papers, thus relieving me of the nurses that were in my charge. Three days later our command was ordered to relieve the First United States Infantry at San Luis. Here we encamped on a hill two miles from town, but heavy rains caused us to move into the village, where the greater portion of the troops were placed in an old Spanish arsenal that had recently been fitted up, the remainder occupying sheds that were originally built for Spanish soldiers. These sheds were very large and well thatched with palm leaves, which effectually turned the rays of the sun and kept out the driving rains. Subsequently the somewhat crowded condition of the troops in the arsenal was relieved by placing a portion of them in tents. Thus we had—during the latter part of the rainy season—some of the men in the house, others in sheds, and still others in tents. If my memory is correct, the statistical record of the health of the troops (after the crowded condition was relieved) showed that those troops in the house did best; the next best were those in the sheds, and then those in the tents. However, the latter troops did very well—the tents having raised board floors and beds three feet above the ground. After the buildings that were previously used by the Spaniards as a hospital had been thoroughly cleaned and fumigated—blankets and linens being burned—I established my hospital therein, putting in about thirty beds. Shortly after this the Twenty-third Kansas (847 men) was brigaded with us, and General E. P. Ewers placed me in command of the medical department of all troops then present—the Eighth Illinois, the Twenty-third Kansas, the Signal Corps and the Pack Train. My assistants, aside from those in the Eighth Illinois already mentioned, were Drs. F. D. G. Harvey and C. Sunday, of the Twenty-third Kansas, and Drs. L. B. Bluitt, W. C. Warmsley and I. P. Agostine, the contract surgeons. The number of beds was gradually increased to ninety. "Sick call" was placed under the medical officers of the respective commands, at the temporary field hospitals. The seriously sick and those requiring operation were brought to the hospital buildings in the city, after the manner of the Division Hospital of Col. A. C. Girard.

During my service in Cuba I came in contact with several medical gentlemen to whom I wish to acknowledge a debt of lasting gratitude for their thoughtful consideration of our many

needs and for the unfailing courtesy with which they responded thereto. I allude to Col. V. Havard, Chief Surgeon at Santiago; to Major Sam. Q. Robinson, who at the time of our arrival had charge of the General Hospital, but who subsequently became Acting Chief Surgeon, and to Major L. C. Carr, then in charge of the Medical Supply Depot, but now at the head of the General Hospital. Each of these did all in his power to furnish me with everything necessary for the comfort of my sick.

In regard to the health of the troops, one of the first things which attracted my attention was the fact that the American soldier who drank rum almost invariably came down with fever. The rum seemed to lower his vitality to such an extent that the red blood cells became fruitful culture media for the malarial hematozoon, or plasmodium. General Ewers closed many saloons, and ordered those remaining open to sell no liquor to soldiers, under penalty of being immediately and permanently treated likewise. To a great degree this prevented an increase of fever cases.*

The ration of our soldiers was generous, nutritious and varied. Three things favored us: First, we had a number of excellent cooks with us—men who knew how to make nutritious and palatable dishes from the most simple materials. Second, the majority of the men were not connoisseurs of the culinary products of a Delmonico, many of them having been daily patrons of the migratory Chicago restaurants. Third, the men were of powerful physique and hardy constitution. The clothing and foot-gear were all that could be asked, but I believe the campaign hat might have been supplanted by the cork helmet to very great advantage.

The men were ordered to eat and drink only that which

*This is quite different from the report of Capt. C. E. Woodruff in the Philippines. He quotes the general order issued from Army Headquarters July 2, 1898, which says: "The history of other armies has demonstrated that in a hot climate abstinence from the use of intoxicating drink is essential to continued health and efficiency." He would change this so as to read: "Experience has demonstrated that in a hot climate the moderate use of intoxicating drink is essential," etc. He cites the Manila epidemic of insanity as due to heat, and—by implication at least—suggests alcoholic drink as a preventive because one Spanish military surgeon said that a certain amount of wine daily was essential in that climate. I believe people in warm countries take wine because good water is hard to obtain, and not because it prevents neurasthenia. The poorest of Cubans have a water filter, and they take coffee rather than spirituous liquor to sustain nerve force. Without any personal knowledge of Philippine conditions, I believe the War Department order is right. Alcohol as a needed medicine is one thing. Alcohol as a daily ration is another. The first is and should be granted. The last is not and ought not be furnished. I recall Lieutenant C——— of the Signal Corps, who was almost perfect in physique. Though never

the United States furnished them, and were especially warned to keep away from fruit. Being but children of a larger growth, this caused some of them to eat it more freely at every opportunity. The wisdom of the order, however, was proved by the fact that the disobedient quickly and invariably found their way into the hospital.

Malaria.—At San Luis the first disease encountered was malaria, of which we handled more than two thousand cases. We had mostly to do with the benign tertian and quartan types. Very frequently in this disease we were called upon to note the unexpected symptom, slow pulse, in connection with rise of temperature. A very interesting case was that of a young man of rather robust habit, who had been in good health, but who was suddenly stricken with a profuse epistaxis, which resisted all kinds of local treatment. After a few days it was noticed that the hemorrhage was most profuse daily about 10 a. m. (sometimes slight in the afternoon), and was accompanied by rise of temperature. Malaria was suspected. Consulting all the authorities I had, the only clue found was in Sir Patrick Manson's very superior work on Tropical Diseases. He stated that this might happen in malarial cachexia. This man was not cachectic, but the reverse. However, he was given large doses of quinine and mineral acid, which stopped both the fever and hemorrhage. This—with other similar cases of malaria—leads me to believe that hemorrhages from the Schneiderian membrane may occur coincident with the paroxysm, even in sthenic cases. The same condition also obtained in the bowel, and (not giving the pathology) I am of the opinion that the malarial germ will attack any mucous membrane and cause hemorrhage under certain conditions.

drunk, he imbibed alcoholic beverages freely. Down with fever, his was the worst case in Santiago, and no human skill could prevent his death. I also recall one of our men who was driven insane by the inferior rum he drank. My experience leads me to believe that much of the insanity among the American troops in hot climates is due to peculiar native drinks rather than to heat alone—though it is but fair to admit that cool nights in Cuba bring rest, which continued heat in Manila forbids. The heat of South Africa is intense, but the English troops are free from insanity. The soldier and alcoholic drink are like the Siamese twins—hard to separate. Suppose our men went to Mexico and partook freely of Mexican pulque, tequila, or mescal, what would happen? It is almost a certainty that they would return mentally wrecked. Is it any wonder, then, that our soldiers in the tropics—taking alcohol in some horrible decoction—become insane? Since the soldier will have alcoholic drink, no matter what the risks necessary to obtain the same, it seems to me that it is wisdom on the part of the Government to advise abstinence and at the same time permit the regimental canteen, as through this agency it can control and prevent, to a very great degree, the indiscriminate use of native intoxicating drinks.

One afternoon there was brought to the hospital a private, unconscious, with stertorous breathing; cold, clammy skin; pulse, subnormal; axillary temperature, 97 deg. No intelligent history could be obtained, as he had not been sick. We did what we could for him, but he never regained consciousness. Not long after this a somewhat similar case was brought in. The rectum was washed out and forty grains of quinine in hot slightly acid solution injected per rectum. The patient was wrapped in blankets with hot water bottles; in thirty minutes he was sweating, and soon thereafter regained consciousness. We then washed out the rectum again, put him on quinine, iron and arsenic, and he made an uneventful recovery without any more paroxysms. In the next case of this kind I used hypodermic, in combination with rectal injection. Results good. We had any number of cases in which there was only one paroxysm, with subnormal pulse. Very much like yellow fever, is it not? We had several cases of dysentery, with bloody stools, the hemorrhage being most severe when the fever was highest. All remedies failed to effect a cure until quinine, iron and mineral acid were given.

The transitional periods—that is, the time of the year when it changes from the rainy to the dry season (or vice versa) were apparently the worst parts of the year for malarial fever.

Screw Worm.—A wholly different case of much interest was that of Private Thomas Dabney. He had reported at sick-call in the field for a short time, complaining of pain in the frontal region and showing symptoms of malaria. The physician in charge had his attention called to the fact that this patient was blowing worms from his nose. He conferred with me, and at my suggestion sent the man to the hospital. On examination I found the superior nasal cavity filled with what proved to be the larvæ of the Lucilia macellaria, or screw worm. They had burrowed in every direction and had devoured the mucous membrane, muscle, periosteum and bone of the palate process of the superior maxilla, for a space sufficiently great to admit a large bean. I at once ordered that a strong antiseptic solution be applied every two hours, and that the nares be douched with warm saline solution every two hours, alternately with the antiseptic solution. This stopped their movements, but did not penetrate far enough to kill them. I then chloroformed the patient, thus killing the larvæ, curetted the cavity, and had no further trouble. The patient made a good recovery. Dr. Manson states that Laboulbène collected thirteen of these nasal cases, of which nine died. Maillard collected thirty-one cases, of which twenty-one proved fatal.

In another case the eggs were deposited upon a wound in the scrotum. The larvæ burrowed up through the fascia lata and between the internal and external oblique muscles. The whole tract had to be thoroughly opened and carefully cleaned out before the patient began to recover.

Sinks.—Regarding camp sanitation, there was much difference of opinion among inspecting officers—one countermanding what another had ordered. For instance, one would say: "Your sinks are entirely too far away; locate them only a short distance from the companies." Then another would say: "Your sinks are entirely too close." In my opinion there are many things that may modify the proper location, distance and depth of sinks—as permanency of hospital structures, climate, character of soil, etc. The hospital structures in San Luis were permanent and were surrounded by a small area of ground; the sinks were a short distance from the buildings, and much deeper than those in the field. I thought this better than having the yard fenestrated with shallow cess-pools of infection, and Capt. R. S. Woodson, Medical Inspector of the Department—than whom one would not wish to meet a more affable, efficient and impartial judge—agreed with me.

Enteric Troubles.—In November, December and January we had the majority of our enteric troubles. The causes were fruit, bad water, and sugar-cane juice; these were supplementary to those which ordinarily bring about enteric disturbances. The accompanying table of dysentery cases, I think, explains very satisfactorily the course of the enteric troubles in the command. Beginning with September the number of cases in the regiment increased, reaching the climax in December, after which time the number decreased.

NUMBER OF DYSENTERY CASES IN EACH MONTH.

IN SEPTEMBER	IN OCTOBER	IN NOVEMBER	IN DECEMBER.	IN JANUARY	IN FEBRUARY	IN MARCH
—13—	—15—	—30—	—41—	—28—	—23—	—15—

Total number of cases of dysentery—165. Total number of fatal cases of dysentery, 4, of which one was complicated with pneumonia.

I wish unequivocally to assert that we never had anything like an epidemic of typhoid fever. We had only two deaths from this cause in the Eighth Illinois, and but three in the Twenty-third Kansas. In this connection I note that Major Victor C. Vaughan, sanitary expert of the University of Michigan, says that "the army surgeons correctly diagnosed less than one-half the cases." If this be true, then we were exceedingly fortunate, for I believe that a failure to properly diagnose this disease among troops can have but one result, and that is an epidemic.

It is supposed variola was brought to Cuba shortly after the Europeans settled here. At all events it has raged there annually for centuries. One would think that through hundreds of years on a small island the population would get what might be called hereditary immunity. I believe we have to a certain extent acquired such immunity by reason of vaccination. However, only one case of variola occurred, and that in a native mail carrier who came to San Luis from Holguin, where Captain R. S. Woodson did such excellent work in stamping out the disease. This case was put out about a mile from town, and there was no spread of the infection. However, our regiment had been vaccinated in Springfield.

Examining Board.—Much unpleasantness sprang up between the medical officers of some of the regiments in the Department of Santiago, and it was impossible to have the sick properly taken care of. General Leonard Wood appointed an examining board consisting of Major L. C. Carr, Major Seaton Norman and Major A. A. Wesley; Lieut. W. W. Quinton, Recorder. After we finished our work everything went on smoothly.

Surgery.—While we were not called upon to perform any major operations, still we had several fractures, dislocations and gunshot wounds of the limbs—none, however, which I now deem of sufficient importance to warrant me in taking the time of the Association to describe.

Water Supply.—During the rainy season there is plenty of rain water for the troops. The dry season begins about November 1st, and by reason of the cessation of the rains the streams grow continually smaller until January, when many of the hitherto roaring rivers have either dried up or become simple rivulets, unfit for drinking purposes. Troops must have water, and it must be the very best they can get. Many November days were spent in locating camps where there would be ample drill grounds and a good water supply; but even at the most available spots, the water had to be hauled quite a distance. One great problem of camp sanitation is how to obtain pure

water. We used filtration and heat—the two best methods of sterilizing water. In the hospital I used the filter; in the camp the water was boiled; but it was difficult to get the men to confine themselves to the use of the latter.

Regimental Data.—In the Eighth Illinois we had about 1,300 officers and men. In Cuba, for the greater portion of the time, our sick rate was about 8 per cent. For a short period it rose as high as 11 per cent. Perhaps you will appreciate the importance of these figures if I state, by way of comparison, that it was said that one regiment, arriving after us, had at one time over 800 sick. That was more in accord with the experience of man; for, says John Hunter, in his "Observations on the Diseases of the Army in Jamaica" (third edition, London, 1808, pages 10-31): "Four regiments were sent from England in 1780, to Jamaica; they arrived there on the 11th of August, and before the end of January ensuing, not quite six months, nearly one-half of them were dead, and a considerable part of the remainder were unfit for service." While the Eighth was in Cuba, Company G had the greatest number of sick—95 out of a possible 104. Company D had the smallest number of sick —83 out of a possible 104. About 14 per cent. of our regiment escaped illness while on the island.

A medical officer of high rank asked me what I thought of the relative sanitary precautions taken by the different regiments in the vicinity, and whether white soldiers in camp would not take better care of themselves than colored soldiers. My answer was that it is purely a matter of equal intelligences—that blacks and whites of the same degree of understanding display a like regard for the rules of health; but the blacks seem to be less fretful than the whites under the rigid requirements of army discipline. I based my reply upon a belief which arose from many careful observations that I made.

So far as I was able to note, the physical difference between the city and the country boys seemed to be in favor of the former, except in venereal cases. Of the latter we had, while on the island, a total of about 8 per cent. sick with gonorrhea, chancroids, and bubo.

The average age of the staff was 38; of the line officers, 23; of the men, 26. We left Springfield with 1,237 men and 46 officers. We returned to Chicago with 1,169 men and 46 officers. We lost 20 by death. In Cuba we lost 15 by disease; by being shot, 3. In the United States we lost 2 by disease.

We left in Cuba 14 sick in hospital, of which number one is said to have died after we returned to the United States.

In looking up the birthplaces of the members of our regi-

ment, I found that many foreign countries, as well as almost every part of this great republic, from the unsalted seas of the North to the briny gulf at the South, and from the " slopes of the sea that sleeps to the banks of the sea that's wild," had furnished the material out of which Illinois had molded the nation's black regiment. Thirty-two States, the District of Columbia, Canada, France, Africa, Jamaica, Nova Scotia and South America were embraced in the list.

Nearly all the trades and professions were represented. There were butchers, bakers, carpenters, bricklayers, stonemasons, etc., ministers, lawyers and doctors. When General Lawton wanted a good cook, he sent to the Eighth Illinois for him; when he desired a good stenographer, clerk or orderly, he sent to the same source, and he always found the desired material.

Causes of Death in Cuba.—Dysentery, 3; dysentery and pneumonia, 1; typhoid fever, 2; malaria, 2; typho-malaria, 1; tetanus, 1; pneumonia, 1; pulmonary tuberculosis, 1; pulmonary hemorrhage, 1; chronic desquamative nephritis, 1; diabetic coma, 1; gunshot wounds, 3.

On March 10 we said good-bye to our lowly Cuban friends and sailed from the land of perpetual summer toward the cooler zones at home. The return trip was made aboard the Sedgwick, which, though smaller than the Yale, was a much better transport, as it was governed by regulations of the War Department. Every morning at 10 o'clock Col. J. R. Marshall, Captain E. W. Hendricks, Quartermaster Johnson and myself inspected every part of the vessel. The ship's officers and the entire crew were not only accommodating but deserve high commendation for the admirable manner in which they performed their various duties. Embarking in shirt-sleeves at Santiago, we disembarked in overcoats at Newport News, without any serious effects from the change. We arrived in Chicago on March 18, 1899, and encamped at Tattersall's until mustered out.

Shortly after our arrival a private entered the drug-room and said he wished to get something to relieve an itching of the skin. Upon examination, he presented all the symptoms of a well-marked case of rubeola. I gave him medicine and at once sent him to his quarters, there to remain until ordered to move. I then telephoned Cook County Hospital. The patient was refused admittance on the ground that the contagious ward was full. At this time the mustering officer, Captain C. C. P. Wainwright, came in. He at once notified Headquarters, whose officials called up the city health authorities, and they in turn called up the Marine Hospital. The medical officer in charge of the latter offered to take the man if he did not have the smallpox.

In the mean time I had isolated both the patient and his bedmate. Dr. Hunt, city health officer, investigated, found a case of measles, and took the patient to the Marine Hospital. It seems to me that the Government should make some preparation in connection with every post for the care of infectious cases.

Conclusion.—In conclusion I would say this:

The co-ordinate branches of the service—the army and navy—seemed to me to be as far apart as if they represented different governments. The fact that the success of one branch might mean the success of all, and the defeat of one branch might prove the defeat of all, should have forbidden the exhibition of any feeling of superiority on the part of either the army, the navy, the regular or the volunteer. Although the war developed this slight friction between the different arms of the service—as well as wide diversities of opinion between the people supporting the same—happily, in the end, "there is glory enough for all." We have only to remember the lesson which the Past has taught, and to faithfully perform the duty which the Present imposes; then will the Future present its star of hope.

As far as it is possible for such a conflict to be a blessing, the Spanish-American War has been one to the United States. It has had a tendency to unite more closely all parts of our Union. It has brought all classes, from the banker to the laborer, nearer together. It has brought the regular military officer in closer touch with the volunteer officer, and each sees more clearly the virtues rather than the faults of the other. It has established the fact that we need a larger army, and has revealed to us the great deficiencies of our ocean transports. It has pointed out the necessity for a greater medical force in the service, and taught us the desirability of a closer relationship between the National Guard and the Regular Army. It has exposed, by an actual test, every weak or defective point in the entire military establishment, and has made us familiar with just what is necessary to the rapid mobilization of 250,000 men.

The war has also demonstrated that the United States has in the negro a potent force that may be used to great advantage in warding off the blows of an enemy. It has placed beyond doubt or denial the negro's fitness to command, and made evident his readiness to obey, even when obedience means for him "the low green tent whose curtains never outward swing." It has demonstrated his unswerving loyalty to the government for which he fell with song on his lips, while from his eyes flashed the ray of hope that in a coming day this nation would cease to permit the acts of degradation and cruelty which are practiced

on his people. The Spanish-American War brought to the negro's heart especial thanksgiving, because he thought it would hasten (in every heart that loves fair play) the coming of the hour wherein the negro would have his name redeemed from color's infamy. However this may be, it should be remembered that among the sons of men there is no class—no race—so lowly and despised that upon it the fate of a nation may not turn, and, in the eternal order of things, we are so bound one to another here in this great republic—

> "That any link you strike,
> Tenth or ten thousandth, breaks the chain alike."

XV. SICK AND WOUNDED SOLDIERS IN PHILADELPHIA AFTER THE SPANISH-AMERICAN WAR.

BY

JOHN V. SHOEMAKER,

SURGEON-GENERAL OF THE NATIONAL GUARD OF PENNSYLVANIA.

The outbreak of the war with Spain took this country by surprise and found it unprepared. Our military establishment, though well modeled and efficient, was small. Although in the course of our national history we have several times been obliged to appeal to the stern arbitrament of war, yet we are in no sense of the word a military or martial people. All our conceptions and habits are based on ideas of peace. Our chief aim is the development of the immense resources of the country and the maintenance of civil and religious liberty. International arbitration is far more in accord with our tastes than the bloody fields of military strife. Nevertheless, at the present stage of civilization, no country can remain free unless it has the spirit to fight, if absolutely necessary, in defense of its rights and convictions. The remonstrances of this government against the tyranny which prevailed in Cuba were prompted by an outraged moral sense. Had they been heeded, our adversaries might have retained their colonial possessions, many valuable lives would have been spared and the perplexing questions in regard to our recently acquired territory would never have arisen. Such a course of events, however, was not to be, and we can only acquiesce in accomplished facts. The possession of a large standing army in time of peace is utterly opposed to American ideas and traditions. Three years ago it almost seemed as if the necessity for any regular force had ceased to exist. The probability of any large or widely spread conflict with our Indians was exceedingly remote and we were at peace with all the world and expected so to remain.

But who can anticipate the course of events? Almost without warning, we found ourselves on the brink of war with a foreign nation. Time became suddenly an element of extreme importance. Our military model must be enlarged. The skeleton of an army must be rounded out to a numerous host. Volunteers must be examined and enrolled. The men must be organized, disciplined, clothed and fed. Provisions must be made for the casualties of service and the sickness of camps. Among

other things, this meant the commissioning of surgeons for the volunteer regiments or battalions. The Civil War was thirty-three years behind us. The lessons learned in that stupendous conflict had perhaps been forgotten. At all events, the men of that era were for the most part unfit for active duty, although there were notable exceptions, and the conditions of military life had changed so greatly in the interval that much had to be learned anew. Every generation of men must, in the main, acquire its own knowledge from its experience and work out its own salvation. Certain grand principles, however, never change. For the prosecution of every work, military or civil, there must be a type—a system or plan. Our type, or model, was our regular army. Its line officers were educated in the art of war. Its medical officers were specially instructed in military surgery. It was, indeed, a happy, and almost a prophetic thought that inspired the present honored and illustrious Surgeon-General of the United States Army to found a school in Washington where young medical officers should supplement the professional training of the medical college by courses of instruction in that branch of their calling which was destined to be their life occupation. The Army Medical School has done a great work during its short existence and its value has been convincingly demonstrated.

Our model was admirable, but the best of systems requires men and time. The men we could soon obtain; the government had but to ask. Time, however, could not be granted. Troops must be massed in camps toward the front and such an assemblage always and necessarily means danger. This has been the experience of armies in all times. More men perish from the diseases of camps than from wounds received on the field of battle. This was the experience of our Civil War and it was, indeed, all of war that the great majority of our soldiers learned in the short struggle with Spain. Since that period we have seen military medical history repeat itself in the Soudan and in South Africa. This contrast between the dangers of the field of action and the camp is heightened now when the improved rifles of the times inflict what we may term merciful wounds, disabling temporarily, but not destroying life in a large proportion of cases.

These remarks are made in no fatalistic spirit or as seeking to deprecate criticism on whatever mistakes may have been made, but simply as a matter of justice in this brief review of the situation.

There is one lesson which, as a member of this Association, I should draw from those events. It is that we, individually and

as a body, should make such a study of all matters relative to camp sanitation that if, hereafter, any emergency unexpectedly arise, we should be prepared to supervise camp life in such a manner as to reduce sickness and death to a minimum. Sickness and death from preventable causes are to be deeply lamented. We have opportunities for practical observations in the summer camps of our National Guards.

While on this subject I will say that I am of the opinion that in matters strictly sanitary more authority should be conferred upon the medical officers or, at least, that their recommendations should receive more consideration at military headquarters. There was much avoidable camp defilement by soldiers who could not realize the importance of sanitation. The bacillus of Eberth was, no doubt, conveyed to the camps through men who were infected before their arrival. I would respectfully offer the suggestion that when a new command reaches a camp already occupied, it should, for prophylactic purposes, be segregated from the troops previously on the spot. An isolated camp, entirely separate and distinct from the main camp for a period of at least two weeks, and so placed that it could neither infect nor be infected by drainage during the stage of incubation, would be a valuable means of preventing the spread of infection. At Chickamauga the disease did not develop until a month or six weeks after the arrival of the first or main body of troops. If all the line officers had acted in perfect and intelligent accord with the medical officers, it is probable that there would have been much less sickness among the troops. It is only by the most rigid precautions on the part of every one concerned that the scourge of disease can be reduced to a minimum among soldiers. And if it be—as it doubtless is—that the men are recruited for the purpose of forming a fighting machine, it is no less a certainty that in order to be an effective military force, the individual units must be kept in the best possible health and condition. From every point of view the interests of the military authorities and the surgeons are identical. The fact is too plain to need demonstration and would need no mention were it not that some commanding officers do not appear to realize its importance.

At the outbreak of hostilities all work of preparation was urged forward with the utmost speed. The resources of the government and the great transportation companies were taxed to the utmost. The newly enlisted troops were congregated in great camps of instruction. While waiting in these rendezvous, typhoid fever began to appear and malaria to develop. The hearts of the people at home were soon pained to hear that

disease was spreading through the camps and carrying off more victims than fell by the arms of the enemy in the field. The private volunteer soldiers had not that ability to look out for their own welfare under such circumstances which is possessed by regular troops.

It has been my privilege and pleasure to have the acquaintance of many of the medical officers of the regular army and I gladly testify to their efficiency. They comprehended their duties and were faithful to their trusts. I can commend also the high standard of education and skill which characterized the volunteer surgeons who entered the service of their country from patriotic motives. These gentlemen met the crisis bravely and brought into requisition every means in their command. Notwithstanding the most earnest efforts of the medical officers, the infection spread. Other natural conditions were present which were beyond human control. The weather was very hot and the flies were very abundant. The camps became hopelessly polluted.

Meanwhile active operations at the front had been suspended. The short conflict of arms had been brought to a successful close. Military movements being no longer required, the removal of sick soldiers to quarters where they might receive more effective treatment than was possible in the field hospitals, was the next object which demanded attention. Arrangements were accordingly made with the state and national governments for the transportation of men who could be safely removed. Hospital trains were provided by the active generosity of patriotic citizens and the sufferers were brought to Philadelphia and other cities adjacent to the principal camps. Many hundreds were received by the hospitals of Philadelphia. All these institutions, according to their facilites, vied with each other in the good work of relieving the ailments of those who had volunteered to serve their country. At other points to which the soldiers were taken, the professional and general interest was equally deep.

The removal of the sick soldiers from the infected camps was a work of humanity undertaken in the interest of the men's welfare and implies not the slightest reproach on those surgeons who had been with the troops on the field of battle and in the camps. These had borne the heat and burden of the day; they had shared the life, the privations and the peril of the men. They had ministered faithfully and had employed every means in their power. Nevertheless, it is plain that with overcrowded field hospitals, overworked doctors, contaminated air and food, a limited supply of remedies and the appliances of our craft,

the men could not be as well provided for as in the well-appointed hospitals of our large cities. These institutions are the growth of time and their resources represent a liberal outlay of money. They are equipped with well stocked pharmacies. They are furnished with all the instruments required for any emergency. They are provided with electrical apparatus and every other device which the ingenuity of man has devised for the relief of affliction. Their larders are plentifully supplied with those articles of food which are wholesome for the sick or are tempting to the appetite of the convalescent. When the soldiers were first received and for some weeks afterwards, it was very warm in Philadelphia, but by means of more than one hundred electric fans we were able at the Medico-Chirurgical Hospital to keep the temperature of the rooms and wards at 65 deg. Fresh currents of air constantly circulated through the apartments.

Above all, the nursing staffs of our hospitals were thoroughly trained and were ready at once to carry on their merciful ministration to the sick. They were, indeed, wonderfully able assistants to the medical staff. When the nurses are acquainted with their duties, the physicians can employ their time to the best advantage. The total number of soldiers cared for by the Medico-Chirurgical College Hospital of Philadelphia was 464 and of these cases only 23 were surgical. Of the remaining 441 patients 266, or more than half, suffered from typhoid fever. We are constantly in the habit of asserting—and with truth—that in this disease very much depends on intelligent nursing. In the camps, the surgeons were obliged to accept the services of men whose former course of life had taught them nothing of the art of nursing. In our hospitals the nurses were specially trained to their work. If, in the management of typhoid fever, a Brand bath were ordered, the attendants knew every detail of the procedure and the order was swiftly and perfectly obeyed. All these facilities, with others which belong to the equipment of a large hospital, had an important influence upon the condition of our patients and were the means, I have no doubt, of saving many a life which might otherwise have been sacrificed, not at all from neglect or ignorance on the part of the medical officers, but because the latter could not command the powerful adjuncts which time and wealth had accumulated in our hospitals. In addition to our regular nursing force we had at the hospital the able assistance of a large number of devoted volunteer nurses. These were ladies of intelligence and culture who nobly and unselfishly dedicated themselves to the care of our soldiers. They were not professionally trained, it

is true, but they were exceptionally resolute and desirous to be of real service. They placed themselves cheerfully and obediently at the disposal of the regular medical and nursing staff, and, stimulated by their patriotic determination, they rapidly acquired a knowledge of their duties and were of valuable assistance in the work. The medical staff also was supplemented by the volunteered services of all the instructors, demonstrators, clinical assistants and other young men connected with the hospital and college. Having at our disposal this large and singularly efficient corps—and its numbers could easily have been largely multiplied, so eager were our friends in the cause—we were able to watch with the closest attention every individual. Each delirious patient had a special nurse at his bedside day and night as long as this symptom continued. In every instance where the man, from whatever cause, fell into a dangerous condition, he had the service of a special nurse and was visited by one of the medical officers at short intervals.

TYPHOID FEVER.

Among our patients afflicted with this disease we observed many unusually severe symptoms and dangerous complications. The principal of these may here be briefly noted.

Temperature.—In twenty-six cases the temperature ascended above 105 deg., and called for special treatment. Mental disturbance, however, was less marked in these cases than in others where the temperature was more moderate.

Delirium.—There was delirium in forty-two of our cases. In some of these it was of a low and muttering type, while in others it was of an active and boisterous character. In some patients it became necessary to adopt measures of restraint in order to keep them in bed and prevent them from doing themselves an injury. Two men developed mania during convalescence. In one of these the fever had departed and he had gained strength enough to leave his bed before the outbreak of mental disturbance. The alienation lasted for a month, during which period he required to be constantly watched.

Epistaxis.—This manifestation occurred subsequent to the eighth day in eighteen of our patients and in one case as late as the twenty-sixth day of the disease.

Diarrhea.—This is a usual concomitant of typhoid fever as seen in Philadelphia, although a proportion of cases are free from this symptom or may even manifest constipation. When the discharges do not average above three a day they need arouse no apprehension. In twenty of our cases this feature was in excess. In this number the discharges averaged more

than eight per diem. In these cases we administered remedies with the object of holding the passages in check.

Tympanites.—A certain degree of tympanites is a characteristic feature of most cases of typhoid fever. In severe cases the flatulent distension of the bowel may be so extreme as to interfere with the action of the diaphragm and embarrass the function of the heart and lungs. Among our sick soldiers eleven such cases occurred. In one of these the distension of the abdomen was enormous, causing excessive pain, difficulty in breathing and prostration. In this case the symptom seemed to be due to the development of peritonitis, not in the usual way by perforation, but from the spread of inflammation by contiguity of tissue through the different coats of the bowel. This patient was notably relieved by the insertion of the rectal tube into the bowel, whereupon large quantities of gas escaped through the tube, and the patient experienced notable amelioration and eventually made a good recovery.

It was somewhat noteworthy that out of so large a number of cases of typhoid fever in young men, many of which were attended by severe intestinal symptoms, not a single instance of perforation of the bowel occurred.

Intestinal hemorrhage.—Hemorrhage from the bowel took place in twenty-one of our soldier patients. In some the hemorrhages were abundant and repeated. In one case no less than eighteen occurred within a period of fifty hours. Another man passed blood from the bowel on twelve different occasions within three days. This case had a fatal termination. Several cases suffered from as many as six or eight free hemorrhages. In one patient so much blood was lost from nine attacks that he was exsanguined and appeared at the point of death. In this emergency recourse was had to hypodermoclysis with a very satisfactory result. A quantity of normal salt solution was thrown beneath the skin by means of the hypodermic syringe. In all probability this procedure was the means of saving life in this case for the hemorrhages ceased, the condition improved and the man eventually was restored to health. The same method was employed in two other cases, in one with good effect.

Jaundice.—Jaundice is not of frequent occurrence and is always of evil import, although not necessarily fatal. In the series of cases here reported it was observed in but a single instance. The patient recovered.

Tonsillitis.—Inflammation of the tonsils is not uncommon in typhoid fever. It was met with in six cases among our soldier patients.

Otitis Media.—Painful suppurative inflammation of the

middle ear may occur from extension through the Eustachian tube. This complication was present in but two of our cases.

Parotiditis.—This is a serious though rather rare complication. It is usually unilateral and leads to suppuration. It was encountered in two of our cases, in each of which the glands of both sides were affected.

Appendicitis.—It would seem, on *a priori* grounds, very probable that the appendix would become implicated in typhoid fever, but such is not the case. Among our soldiers in the hospital, appendicitis existed as a complication in but one case. In this connection I may note the fact that appendicitis occurred in one soldier who was not affected by typhoid fever.

Abscesses.—Collections of pus sometimes arise after the fever has subsided. Five of our soldier patients developed abscesses during convalescence. One of these was the unfortunate individual who had been afflicted by eighteen hemorrhages from the bowel.

Hemoptysis.—This infrequent manifestation occurred in two of the soldiers in our hospital.

Pleurisy.—This is not an extremely uncommon event in typhoid fever and we met with it in three of our cases. Contrary to the general rule these were examples of dry pleurisy.

Pneumonia.—This complication occurred in eighteen cases of our list. In sixteen it was of the lobular variety, while in two cases it was of the lobar form.

Cardiac Complications.—It is known that the muscular substance of the heart is apt to undergo a certain degree of fatty or granular degeneration in typhoid fever. This pathological alteration explains the occurrence among our patients of twenty-nine cases of what we termed circulatory collapse. In these cases there was a decided and abrupt diminution of the cardiac vigor. This feature was witnessed during the third and fourth weeks of the disease. Brachycardia, or slow action of the heart, was also encountered in three cases. The pulse in the patients so affected did not exceed forty or fifty to the minute.

Cystitis.—This was present in seven of this series of cases.

Orchitis.—Two of our typhoid cases were complicated with inflammation of the testicle without any evidence of preceding gonorrhea.

Perisplenitis.—Enlargement of the spleen is of some diagnostic significance in typhoid fever. In five of our cases there was also evidence of localized and circumscribed peritonitis in the splenic region.

Spinal Meningitis.—Actual inflammation of the meninges of the cord is not a usual concomitant of typhoid fever, but one

such case was met with among our soldiers. The clinical features were entirely distinctive and the case had a fatal issue.

Paralysis.—That paralysis sometimes accompanies or follows typhoid fever was illustrated in two cases under our care.

Phlebitis and Thrombosis.—Phlebitis is not an extremely uncommon complication. We witnessed seven such cases among the soldiers treated in the hospital. All these cases exemplified the fact that the general location of phlebitis is in the lower limbs.

Periostitis.—Inflammation of the periosteum is one of the rarer complications and our experience was in accord with the general rule. Only one case of periostitis occurred among all the men.

Erythematous Eruption.—In addition to the familiar rose-colored spots we observed in three cases an erythematous eruption. An erythematous rash is by no means common in typhoid fever. In two of our cases the rose-colored spots and the erythema were present at the same time; in one case the erythema made its appearance after the characteristic exanthem had faded.

Purpura.—The infectious influence of typhoid fever occasionally produces an outbreak of purpura. Two of the soldiers in our wards were affected by this hemorrhagic disease in the variety known as purpura simplex. There was no bleeding from mucous membranes.

Recrudescence and Relapse.—In this list of patients there were twelve recrudescences, that is, return of fever without the general systemic symptoms. In an equal number of cases true relapse occurred; namely, fever accompanied by the symptoms of typhoid fever. Two of the relapses took place in men who were brought to the hospital in a state of convalescence.

Yellow Palms and Soles.—Of this peculiarity, which has only been described of recent years, we observed three instances. The discoloration makes its advent early in the disease and continues until convalescence has been established. It is more perceptible where the skin is thickest.

Widal's Test.—This test will often give a positive result before the symptoms of typhoid fever are presented with sufficient clearness to warrant a confident diagnosis. It is, consequently, of much assistance in foreshadowing the course of events. In the blood of a typhoid fever patient the characteristic clumping or agglutination of Eberth's bacilli occurs within a few hours after the proper manipulations have been made. This test was carefully applied in 231 of our patients belonging to the series on which this paper is founded. In 219 of this number a positive reaction was obtained. In ten cases, although repeated

examinations were made, the test failed. Nevertheless, every one of these ten men exhibited the undoubted features of typhoid fever. In two more cases the procedure also yielded negative results, and in these cases some of the usual manifestations of typhoid fever were absent. The following table gives the time of occurrence of Widal's reaction:

128	cases	gave	positive	reaction	on or before the 8th day.	
36	"	"	"	"	between	8th and 14th day.
45	"	"	"	"	"	14th and 21st day.
8	"	"	"	"	"	21st and 25th day.
2	"	"	"	"	"	25th and 28th day.
219						

Treatment.—On admission, all the stages of typhoid fever and many of its complications were represented among the soldiers. No rigid system of treatment was outlined, but each individual case was managed according to the indications which it presented. To this statement I need only make the exception that the hygienic and dietetic measures adopted were much the same in all the cases and were only varied in obedience to the demands of the various complications which arose.

(*a*) *Hygienic Management.*—All the patients were put to bed immediately on their arrival. Each bed had a spring mattress, sheets, etc., and a mackintosh was placed beneath the sheet. In order to prevent bed sores each patient was rubbed with alcohol every evening, and during the day when deemed necessary. These rubbings also refreshed the men. The mouth and teeth were cleansed daily with a boric acid solution, to which, if the tongue were hard and dry, some glycerine was added.

(*b*) *The Diet.*—The regimen was arranged with the view of furnishing nourishing, easily assimilable and unirritating foods, to be given in definite quantities and at stated intervals. The main reliance was milk. About three pints were given in the course of the twenty-four hours. The evacuations were carefully scrutinized in order to learn whether the milk was or was not thoroughly digested. At the first appearance of solid curds in the dejecta or at signs of the slightest tendency to irritability of the stomach, the milk was either peptonized or alkalinized. Lime juice also was added to the milk when the digestive power was decidedly feeble. If these measures did not suffice, or if the patient was unable to take this quantity, the amount was reduced and meat juices or bouillon employed as substitute. Clam broth was sometimes better borne than milk. This broth has the advantage over many liquid foods that it allays

nausea while at the same time it is possessed of nutritive value. Mutton broth was likewise often found acceptable as a substitute for an exclusively milk diet. In similar conditions we made use of a nutritious beef essence prepared by browning the beef on each side and expressing the juice. This juice was given where there was not much diarrhea. In some cases of extreme intolerance of the stomach we had recourse to the injection of nutritious fluids into the rectum. In this manner we introduced milk and white of eggs. In the beginning of convalescence we permitted our patients to partake of boiled rice, entire soft-boiled eggs (diluted) and thin custards, the return to solid food being gradual. Cracked ice and cold water were given in large quantities and likewise toast-water or water containing the white of a raw egg strained through a cloth. In some instances the condition permitted the use of coffee, tea or lemonade.

(*c*) *Stimulants.*—These were administered when there were marked muscular depression and feeble heart, and to those patients who were more or less habituated to their use. We began with moderate quantities and increased the amount according to the exigencies of the case. Stimulants were given in the form of brandy, whisky and champagne and other wines. In threatened collapse full doses of alcoholic stimulants were supplemented by strychnin, digitalis, sulphuric ether and ammonia.

(*d*) *Temperature.*—However highly and deservedly we may esteem Brand's method, yet it does not apply universally to every case and every stage of typhoid fever. So exhausted were our patients, owing to the progress which the disease had made before they were admitted, that we were soon led to abandon the use of the tub baths in favor of less rigorous methods. Our principal reliance was placed in cold sponging and the ice-pack. These applications were refreshing to the patients and were totally free from any tendency to aggravate complications or produce hemorrhage from the bowels. As soon as the temperature reached 102 degrees, the patients were sponged with equal parts of alcohol and water. If the thermometer registered 103 degrees or more the ice-pack was used in the following manner: The patient was laid on a blanket and wrapped in a sheet wrung out of water at a temperature of 70 to 80 degrees. The heat was also somewhat reduced by rubbing the body with ice. The ice-pack was repeated every few hours until the temperature remained at or below 102 degrees. If the temperature was not diminished within half an hour after an ice-pack had been administered, an alcohol rub with a quinine suppository containing ten grains of the alkaloid was given with good effect.

(*e*) *Drugs.*—The drugs made use of in our treatment were those which reduce fever, cleanse the intestinal canal and support the strength, especially of the enfeebled heart. Those most frequently ordered were quinine, salol, creosote, turpentine, calomel, digitalis, strychnin and alcohol in the forms which we have already mentioned. For the dry, glazed tongue of the typhoid state, in addition to the local use of the boric acid and glycerine solution, we witnessed improvement from the administration by the mouth of turpentine and terebene.

I may in this connection appropriately mention the plans adopted for the amelioration of certain prominent and dangerous symptoms and complications.

Hemorrhage.—In cases of hemorrhage we placed an ice-bag over the abdomen and packed the rectum with ice. In ternally we administered acetate of lead and opium or teaspoonful doses of the fluid extract of witch hazel every few hours. The foot of the bed was elevated and in some instances hypodermic injections of ergotole were given. When the hemorrhage was excessive, we employed the intravenous injection of the normal salt solution. At the first evidence of hemorrhage the usual amount of nourishment and drink given to the patient was diminished.

Pneumonia.—In this complication we relied principally upon turpentine and terebene. These substances antagonize the activity of the bacilli, while at the same time they exert a beneficial influence upon mucous membranes and nerve centers. When the heart's action was weak and irregular we furthermore administered digitalis, strychnin and alcohol, and enveloped our patients in jackets made of raw cotton.

Diarrhea.—With mild diarrhea we did not interfere. When the discharges became excessive in number or abundance our chief remedies were those classed as intestinal antiseptics, such as salol, beta-naphthol, creosote, etc. If these failed in efficiency, they were reinforced by bismuth subnitrate, which possesses similar properties combined with more decided astringency. In some cases still more energetic measures were demanded. In these we had recourse to a pill of silver nitrate combined with opium. The pill was given every second hour until the desired effect was produced.

Delirium.—In many cases the sponging with alcohol and water and the ice-pack employed for the purpose of reducing the fever were likewise effective in calming the delirium. When these means did not suffice, suppositories of hyoscyamus or cannabis indica were generally able to quiet the disordered action of the brain.

Thrombosis.—The affected limb was kept strictly at rest in an elevated position. Pain was relieved by wrapping the member in raw wool and applying a bandage or, in some instances, by rubbing the surface with an ointment composed of sulphur and belladonna.

Peritonitis.—Only one case occurred. In addition to the general treatment its most distressing feature, tympanites, was relieved by the use of a tube passed into the lower bowel, as has already been mentioned when speaking of the complications encountered.

In the management of the cases entrusted to our care our utmost efforts were put forth and all the accepted methods of medical science were, at one time or another, employed as the circumstances of individual cases demanded. Thirteen patients, however, were so profoundly infected that all our efforts were unavailing and that number perished. The men bore their sufferings with admirable patience and fortitude. Those who were fatally stricken met their fate, when their consciousness had not been obliterated by the disease, as brave men should. The death list is equivalent to a roll of honor.

Our only deaths were from typhoid fever.

MALARIA.

Fifty-three of the soldiers were afflicted with malaria. When malarial fever, particularly of the remittent type, has advanced to the tenth or twelfth day without careful or systematic treatment, the patient is very apt to fall into the typhoid state and at this time, in this condition and in the absence of a detailed history with temperature charts, it is by no means easy, by mere examination of a very ill and listless patient, to differentiate the disease promptly and positively from typhoid fever. Again, although it is rather a rare event, we must not lose sight of the fact that malarial and typhoid fever may coexist in the same person. In not a few of the soldiers their condition on arrival was such that it was impossible to frame an exact diagnosis without close observation during a certain period. The malarial parasite, when discovered in the blood of the patient, is of absolute diagnostic value. The plasmodium malariæ, or hematozoon, locates itself in the red corpuscles of the blood. The different forms which the parasite assumes seem to bear some relation to the different clinical forms of acute malarial intoxication.

Professor Koch, as a result of his researches in German South Africa, writes that tropical malaria is peculiar by reason of its course and the particular species of blood parasites which accompany it, and that there are but two factors which can

be seriously considered as media of infection. The parasites are distributed through drinking water and the agency of mosquitoes. The latter is, according to his belief, probably the sole cause. The investigations of Koch have gone far towards corroborating the opinions originally enunciated by Sir Patrick Manson. The experiments of Surgeon-Major Ronald Ross also tend to the confirmation of these views. For further information regarding the subject of malaria we shall watch with great interest the studies being made in West Africa and the Roman Campagna. Dr. MacCallum, of the Johns Hopkins University, has also been instrumental in the prosecution of these inquiries.

Treatment.—We did not regulate the diet of our malarial patients with such rigor as that of those suffering from typhoid fever. In the more severe types of malarial fevers, however, such as were exhibited by our patients, there is considerable, and frequently excessive, intolerance of the stomach. Hence, the food must consist of such articles as are both nutritious and easily digested.

As regards medicinal measures quinine was, of course, our sheet anchor. We were successful by its aid in bringing all our cases to a favorable termination. The only questions which arose concerned the form and manner in which it should be given as well as the time at which the dose should be administered. Whenever possible it is advisable to precede the exhibition of quinine by an active purgative. This is particularly desirable in remittent fever. In this variety, also, it is not infrequently necessary to prescribe agents which shall allay the intense irritability of the stomach. In the graver forms of tropical malaria every instant is precious, and we must use the hypodermic method without delay.

XVI. TETANUS IN MILITARY SURGERY.

BY

MAJOR NARCISO DEL RIO,

ARMY SURGEON OF THE MEXICAN REPUBLIC, VERA CRUZ.

In tropical climates, the soldier has a terrible enemy in tetanus, which frequently complicates the most extensive wounds as well as the most insignificant excoriations, and makes desperate, in many instances, the military surgeon who sees his wounded men die sometimes in really alarming proportions.

According to the statistics of Mathieu, the average mortality from tetanus is eighty-eight per cent. of those attacked and as, in the tropics, the number of these may be rather large, the great necessity of the greatest precautions to prevent the development of so dangerous an illness will be appreciated. In cold and temperate climates, the number of tetanic patients is small, though the mortality is always large; but, in the tropics, it must be considered as a relatively frequent condition and, for this reason, the precautions taken against it ought to be greater.

In classic pathological works, written a few years ago, causes of tetanus were pointed out, that we consider nowadays as merely occasional and which are now relegated to the second place. Exposure to cold weather, abrupt changes of temperature, moral depression and many other causes, that were pointed out to us as capable of originating tetanus, will never produce this illness in man if he has not been before invaded by the bacillus of Nicolaïer—the only and necessary cause for becoming tetanic. The magnificent studies of Kitasato, Vaillard, Tizzoni and Catani, verified afterwards by the conclusive experiments of Nocard, do not leave any possible doubt regarding this point.

According to these experimenters, the bacillus of Nicolaïer remains lodged in the wound or excoriation that served it as a door of entry to penetrate into the organism, and it has never been possible to find it in the viscera, in the blood or in any other humor. In the wound it remains, being a focus for the elaboration of toxic matters that, on diffusing themselves in the animal economy, will produce the tetanic intoxication. In the wound, nothing indicates the presence of the infection which will bring along the toxemia almost necessarily mortal.

The frequency of tetanus in dirty wounds had been noted

a long time ago, in those wounds inflicted with agricultural implements, and in persons in contact with domestic animals, notoriously the horse. This frequency led Verneuil to attribute an equine origin to the illness. Now we know that damp cultivated soils and the dung from stables are places of predilection for the bacillus of Nicolaïer, which lives in the superficial layers of such grounds. This fact explains to us the frequency of the malady in the cases we have mentioned before, and also why one case is followed by another in the same ambulance or in the same saloon, and also explains the epidemics in maternity asylums, among new-born children, and that one observed by Larrey, the night after the battle of Bautzen. The place occupied by those wounded men furnished the tetanic germ, the other causes being accessory.

These antecedents being stated, we shall see that the soldier is exposed to tetanus, by the wounds he may receive in battle, by the hurts and excoriations so frequent in marches, by the place where he may pitch up his camp, which generally is on cultivated ground, and by the propinquity of the horses indispensable to an army. Any erosion of the skin, however slight it may appear, may be the door of entrance to the bacillus, and it is known that these erosions in troops marching, are more frequent in tropical regions where, to the fatigues of the climate, must be added the inconvenience of the roads, which are generally rough and poorly kept.

Another important factor in the production of tetanus, nearly exclusive to the tropics, is the parasite "pulex penetrans," vulgarly called chigre (*nigua*) in Mexico, that abounds on the coasts of that country, and above all in the Antilles islands. Bonnet has observed a man who had in his body more than three hundred of these parasites. These parasites live on the soil in a free state and attack man for the purpose of sucking blood, just as the common flea. When the female is impregnated, it tries to fix itself in the body of an animal to assure its life till the gestation has finished. As it lives in the ground, it fixes itself preferably in those parts of the animal that are in contact with the floor, as the feet in men, where it penetrates under the epidermis and, by means of its buccal apparatus, perforates the dermis, remaining there till the gestation period is finished. At the end of this period, its abdomen is broken for the expulsion of the eggs and its body remains in the wound, which commences to waste in order to throw out the offending body. It is a common practice in the tropics, among people invaded by this parasite, to extract the insect by means of a pin with which they prick themselves in that part of the skin

where the chigre has entered and, by a combined rotary and lever movement, extract it.

It is easy to understand that these animals which live, as a rule, in the ground may, when they penetrate under the skin of a man, introduce the bacillus of Nicolaïer, or that, in the skin of the man, there may be some of these bacilli, which are inoculated with the pin when trying to get out the chigre, or the pin may be infected by the bacillus. In these three ways, the illness or infection may be gotten and, for this reason, it is frequent. Nearly one-half of the cases of tetanus that I have observed in Vera Cruz, have been due to chigres, which are very numerous in the neighborhood of that city, and it is a rather general notion among people that tetanus cases on account of chigres are more frequent when the insect is extracted by means of a pin, than when it is killed in the wound by means of petroleum, turpentine, or mercurial ointment, which seemingly confirms my assertion that the production of the malady is largely due to extraction.

The military surgeon on campaign, in marches with a battalion or regiment and in garrison, in tropical climates, must always have in mind these several factors for the production of a sickness so dangerous, "the most terrible of complications in a wound," as it was called by Nélaton; and it is his duty to try, by all means within his reach, to prevent the appearance of so terrible an illness among the soldiers given to his care. He must not for an instant forget that he can do much to prevent the appearance of the illness as well as that he can do little to combat it when it has developed. He must always bear in mind that only in the wound is to be found the pathogenic agent, that tetanus is rather an intoxication than an infection, in the true sense of the word; that the intoxication takes place in the wound, where silently the toxic matter is elaborated which, on diffusing through the organism, will give birth to the clinical picture so well known to us. In a word, the preventive treatment of tetanus is one of the most glorious conquests of modern medicine; while the curative system is as uncertain as it used to be many years ago.

The military surgeon in the tropics must consider as suspicious any wound or simple erosion that has been stained with soil whether by direct contact or by immediate contact with animals or agricultural implements, and also those men who have been encamped in cultivated lands or who have to remain a long while in stables and have been invaded by chigres from those places. In these suspicious cases he must intervene, and intervene as soon as it is possible to do so, in the conviction that

if the traumatism of his patient is not tetaniferous, his intervention cannot harm him and, on the other hand, if the wound lodges the bacillus of Nicolaïer, he can destroy it there, preventing its fatal results.

With this conviction he must carefully wash every wound, erosion or hurt of the skin, with an antiseptic liquid, doing this washing profusely until he is sure that the traumatism is absolutely clear of tetanic germs. Chigres will be extracted by means of an incision, afterward washing with the antiseptic liquid all the cavity where the insect has lodged. The washing finished, he should apply a Lister dressing and inject into the cellular subcutaneous parts ten cubic centimeters of anti-tetanic serum, to be repeated a few days after.

Prevention of tetanus by serumtherapy is one method that has made progress the more decisive, deserving from the illustrious Roux those memorable words which he pronounced in Buda-Pesth; that the importance of serumtherapy had not been understood till the works of Behring and Kitasato about tetanus and diphtheria appeared. The explanation must be accepted that it acts directly upon the toxic matters. Or that given by Commont and Doyon, about the strychnia-like substance which they claim to have isolated from the muscles, the blood and the urine of animals dead on account of tetanus. The truth is that on practical grounds its effects are sure and decisive.

Taking into account the ease of transportation, the military surgeon must prefer the anti-toxin of Tizzoni and Cattani, very commonly used in Italy and England, which is presented in the form of powder, easy to preserve and carry about. One gramme of this anti-toxin is equivalent to ten cubic centimeters of serum and as one gramme is easily dissolved in ten cubic centimeters of distilled water, it can be dissolved immediately before the injection is to be made.

If unfortunately some case of tetanus should present itself, whether it be on account of the wounded man not having been under the care of the surgeon, or that his intervention has been late, or that there has been neglect on the part of the man to advise him of the excoriations he has suffered, or of the presence of chigres, the serumtherapy must be employed in large doses combined with the administration of laudanum in strong and repeated doses, medicine a great deal superior to chloral, the bromides and other substances generally used. In those cases of illness already declared, serumtherapy is but little sure in its effects. However, though many cases have beeen registered in which it has been powerless, some have been also noted, though

small in number, in which it has been efficacious, and this is sufficient authorization for the surgeon to use it, in case of so terrible a sickness.

Discussion on the Paper of Major del Rio.

Col. N. Senn, Ill.—I had the opportunity of examining about 1,250 wounded men in Cuba and about 50 in Porto Rico and there was but one case of tetanus and that occurred in a Spanish prisoner. He had a most acute form of tetanus and died in less than twenty-four hours. As to an abrasion being the infection atrium for a tetanus bacillus, we all know that the tetanus bacillus is an anaerobic microbe and that it will not reproduce itself in the presence of oxygen. I do not believe that I have ever seen a case of tetanus in connection with a simple operation. In all cases of tetanus infection the wounds are penetrating; the tetanus bacillus must find its way deep into the tissues and it was the only place in which it was isolated by Kitasato.

I remember very distinctly an interview which I had with Professor Koch and with Dr. Rosenbach before the tetanus bacillus was isolated. We discussed the matter for an entire evening and Koch made the assertion that if we would proceed in a certain way we would surely be able to obtain a pure culture of the germ. The distinguished bacteriologist of Japan followed out the suggestion and found the bacillus. Tetanus will never follow a simple operation and I think my colleagues will bear me out that in our own climate we find tetanus most frequently about the Fourth of July, when we have so many penetrating wounds.

As to the value of the anti-tetanic serum, in which I have absolutely no confidence, I can probably not furnish a better proof to substantiate my position in this matter than by citing what I saw in Vienna at the Rudolph Hospital, where they manufacture this serum and keep horses for experimental purposes. The director of that institution informed me that he had lost three or four horses in a very few weeks. The serum treatment was given immediately after the horses were taken sick but every one of them died. We have here absolute proof of the unreliable nature of the tetanus anti-toxin. I have much more faith in the treatment by the parenchymatous injection of a five per cent. solution of carbolic acid. That is the treatment I have relied upon and it has yielded most magnificent results. I believe that there are very few cases of acute tetanus in which we can say positively that the serum had any influ-

ence whatever. We must not forget that tetanus should be divided into three varieties: The very acute form, which kills in twenty-four hours; the subacute cases that die in three or four days and the chronic cases.

Gen. J. T. Priestley, Ia.—Three months ago I saw a case of tetanus die, the infection having followed a simple abrasion of the skin of the face. A driver of a dirt cart, who collected the dirt from the streets, fell on the side of his face, causing an abrasion. He died in less than five days afterward from acute tetanus. I have also seen two other cases of tetanus within the last six months, in which the serum treatment was used extensively but without any good result.

Lt.-Col. R. J. Fitzgerald, Minn.—In my experience in the Philippine campaign, three cases of tetanus came under my observation. One was a gunshot wound of the chest and the other two of the extremities. I have been informed by the surgeons of both the British and the Spanish armies that the tetanus bacillus is extremely common in the regions of the archipelago. Great surprise was expressed by these gentlemen that so few cases came under our observation as they were very common among the Philippinos and the Spanish. I believe we owe this to the timely application of the first aid dressing and the thorough cleansing of the wounds at the time or shortly afterward. The serum treatment was resorted to without any good result in these three cases. The experience was devoid of any new features, in fact it proved fatal.

In my early experience in Nicaragua I was unfortunate enough to have a jigger in the plantar surface of the left foot. I had an acute attack of tetanus, not severe at the start, but it became chronic. I am a living example of the expectant treatment used. For many years the physicians claimed that certain constitutional impairments, from which I suffered, were due to the tetanus.

Lt. G. B. Cowell, Conn.—It is a well-known fact that tetanus often develops after operations in certain parts of this country. There are parts of Long Island which have a reputation for producing tetanus. Veterinary surgeons do not castrate horses because of the alarming prevalence of tetanus. It is supposed to be due to the condition of the soil. It is very probable that, as no antiseptic precautions are used, when operating on horses, the animals are permitted to infect themselves in the stables, and as there is oftentimes no air present to interfere with the production of the germ, it thrives. The serum treatment, as applied in the vicinity of my home, has proven to be of some good. If the tetanus develops after a few days, the cases are

more likely to recover and they are the ones where the reports have been in favor of the tetanus serum. It is likely that these cases would have recovered under the old expectant method of treatment. In all the cases coming under my observation there has always been a retraction of tissues in which the germs could develop without air. It is a well-known fact that men working about stables are very liable to be infected with tetanus as the manure favors the development of the tetanus germ.

Major J. LaPierre, Conn.—I have been very much interested in the paper and the remarks it has brought out. In the summer of 1898, being post surgeon in Camp Haven, there were 1,700 men under my observation. The only death occurring during the time of the camp was from tetanus. There was no history of any penetrating wound or abrasion of the skin. On the first day of July the entire body of men were vaccinated and about three weeks after this a case of tetanus, of the subacute type, developed. He died within three days. Owing to the hot weather and the every-day drill, many bad sores followed the vaccination, although this case was not an exceptional one. I simply mention this as it might be of interest to know how frequently the tetanus follows vaccination.

We know that there are certain sections of this country where the bacilli are supposed to be more abundant than in others. A portion of Long Island is especially infested with it. It would be of interest to know whether there were any cases of tetanus at Montauk, where the troops rested after their return from Cuba.

Major Azel Ames, Mass.—With reference to the remark of the last speaker, I wish to say that in the seven hundred thousand or more cases of vaccination in Porto Rico we had but one case of tetanus, a case occurring under the observation of Dr. F. G. Reynolds. It was reported to me shortly after its occurrence. We kept a very sharp watch and asked all the vaccinators of the Island, some fifty in number, to be on the lookout, but only this one case of tetanus occurred.

Surgeon George Vaughan, U. S. M.-H. S.—I am inclined to agree with Dr. Senn in regard to the lack of success accruing from the use of the serum. I have tried it in three cases of the three types Col Senn described. One recovered, and I think that he would have recovered without any treatment whatever. The other two died. Injection of the serum into the brain substance has been reported in at least one-half dozen cases which nearly all recovered.

Capt. George Gandy, U. S. A.—I would like to speak of a case which came under my observation while attached to Fort Slocum near the Long Island shore where the tetanus germ was

supposed to be prevalent. My assistant surgeon met with a case of tetanus in a member of the hospital corps. This man was found in the garden with all the signs of tetanus. Dr. Gilman promptly diagnosed the case, took the patient to the hospital, examined him and found an old wound on the plantar surface of the great toe. It was inflicted while the man was working in the garden a few days before, by a rusty piece of wire. The wound was opened, curetted and washed and the doctor proceeded to give the serum in the usual manner. The man made a fairly good recovery. When I returned a few days later he was still having recurrent paroxysms. I was satisfied with the diagnosis and with what had been done. I thought it was another addition to the testimony as to the curative value of the serum. The man was fairly intelligent and read a good deal, mostly matter which was exceedingly beyond the ordinary hospital corps man. He was reading also another class of literature, the yellow journal variety, in which he read of a case of tetanus following a wound from a toy pistol.

This man recovered but afterward had similar attacks and we doubted our diagnosis. In one of these attacks we omitted the serum and antispasmodics, applied the restraint apparatus and found that the attacks were cut short quite perceptibly. They also became less frequent. Subsequently we found the man going off on another tack; he had cataleptic spells and then we began seriously to doubt our diagnosis of tetanus. He was eventually discharged from the service for paralysis of the fore-arm without any possible reason for its existence. It was undoubtedly a functional paralysis. We could do nothing for him and he went into so many different forms of hysterical manifestations that we had to discharge him for disability.

There was a case in which, if there had been but one attack, we both would have been ready to say that it was a case of acute tetanus which was cured by the use of the anti-toxin.

Lt.-Col. J. D. Griffith, Mo.—Did I understand Dr. Senn to say that the tetanus germ could not live in the presence of oxygen?

Col. Senn.—No, it cannot. That was the trouble in Koch's laboratory for they could never cultivate the germ in a pure culture. It was always contaminated and therefore they finally grew it in an atmosphere of hydrogen. It is absolutely impossible to have a case of tetanus follow a simple abrasion because of the presence of oxygen.

Lt.-Col. Griffith.—There is a portion of Long Island in which, when any one walking along the sand is wounded in the foot by a fish bone or anything else, he immediately goes to some

hospital in New York. When he arrives there he develops tetanus. I have seen at least forty-five cases of this kind, the patient dying very rapidly with all the symptoms of tetanus. Now, then, if the tetanus germ is a facultative anaerobe it would readily explain the occurrence of these cases of tetanus. I have heard old Dr. Wood speak of it time and again. He always said that these cases are very dangerous cases and die very rapidly, usually within three or four days after having been wounded. It is strange that this germ cannot exist in the presence of oxygen and yet it is apparently very near the surface and remains there for a long time.

Lt. H. A. Arnold, Pa.—Penetrating wounds in the tropics are extremely dangerous and liable to be followed by tetanus. We disembarked in Porto Rico rather hurriedly during an intense storm. Our first camp was on the plaza surrounding the Catholic church, which during the time not occupied by us was in undisputed possession of filthy natives, cattle, saddle-back hogs, and other animals, and centuries of this condition would make it anything but desirable for camp ground, but it was the only place we could get. We had been there for a few days when one of the tropical storms occurred and we were simply deluged. The following morning the men removed their shoes and stockings and waded in over fifteen inches of water in order to remove their effects to higher places. During this time a number of penetrating wounds of the feet occurred. Being with the cavalry we had plenty of baled hay with us. This hay had been dragged around the dock and the outer surface was contaminated. The wires holding it together had been thrown about the camp. These wires were largely the cause of the wounds of the feet, which penetrated a considerable distance. I watched these men very closely. About the same time one of the men bathing in the bay injured his foot and found projecting from it a bit of wire. He attempted to remove it, supposed he had done so and did not report to me. After about twenty-four hours the foot was exceedingly painful. On examination I detected some of the wire which had penetrated the os calcis and had been broken off. I made what appeared to me to be a large wound and made a thorough application of a strong solution of bichloride of mercury. All these wounds, penetrating in character, occurred amongst the most filthy surroundings, one can scarcely conceive of the condition of that camp, and in not one of the cases did tetanus develop.

XVII. MILITARY SURGERY.*

BY

CAPTAIN W. C. BORDEN,

ASSISTANT SURGEON, U. S. A.

Military surgery may be defined as the application of surgical methods, under the conditions which obtain in war, to the treatment of traumatisms made by military weapons.

In military surgery three main factors present themselves for consideration: First, the character of the traumatisms inflicted in war; second, the treatment to be adopted; third, the conditions under which the patient is placed during treatment. The practice of military surgery therefore demands of the military surgeon a knowledge of these factors and of their relation to each other.

It may at once be stated that of these factors two are of preeminent importance in modern military surgery. These are the character of the wounds inflicted by the small-caliber compound bullet now so largely used, and the effect of the application of the principles of aseptic and antiseptic surgery to the surgery of war. The first derives its importance from the fact that the great majority of wounds in war are due to rifle fire; the second, to the fact that aseptic and antiseptic methods are applicable to all wounds, however inflicted, and that the application of these methods has as greatly affected the treatment, progress, and prognosis of the traumatisms of war as it has surgery in general.

It is necessary, therefore, to consider the character of wounds received in war, both in their immediate and remote effect, their course and treatment, and the conditions under which the patient is likely to be placed during the time of treatment.

* The paper signed "Edro" was awarded the Sander gold medal for the best paper on military surgery, submitted for competition at the annual meeting of the Association of Military Surgeons of the United States, held in New York City, May 31 to June 2, 1900. The committee of award consisted of Brig.-Gen. J. D. Griffith, Surg.-Gen. N. G. Mo.; Medical Director Geo. W. Woods, U. S. Navy, and Major A. C. Girard, Surgeon U. S. Army.

Traumatisms which might be treated conservatively in civil practice, often require radical operations under the environment and conditions incident to military surgery; and, on the other hand, injuries which, in civil practice, would require immediate surgical intervention, are frequently best treated expectantly, under the conditions which obtain in the field. The latter is well illustrated in the difference which obtains in civil and military surgical treatment of gunshot wounds of the abdomen. With the resources of the civil hospital and surrounded by aseptic safeguards, the civil surgeon uniformly opens the abdominal cavity wherever penetration of this cavity by gunshot is suspected; while the military surgeon, having in view the frequent recovery of such cases when treated expectantly, and knowing the almost absolute certainty of producing infection under the conditions which obtain in field hospitals, does not usually resort to laparotomy unless death without operation may be considered certain.

While the conditions incident to environment are practically similar for all classes of wounds received in war, in that all are received in the field and have to be treated under the restrictions imposed by the location and the supplies at hand, the traumatisms themselves may be divided into two great classes, in accordance with the weapons by which they are inflicted. This division arises from the fact that one class of wounds, and that comprising the greater number, is characterized by peculiarity of form, complication, and course of healing, while the other class does not differ markedly from the traumatisms often observed in civil life.

To the first class belong all bullet wounds; first, those made by the small caliber compound bullet; and second, those made by revolver and shrapnel bullets. Of this class those made by rifle-bullets are the most important, as they are by far the most numerous, and as they produce traumatisms having special characteristics.

To the second class belong all wounds made by missiles of large caliber, by fragments of shell, by indirect missiles, by bayonet, lance, saber, or like cutting or puncturing weapons. The wounds of this class furnish the minority of cases and are all characterized by being more or less lacerated, or by having a considerable extent of skin-surface involved and by being almost invariably infected, thus necessitating their being treated as infected wounds and by the open antiseptic method. The comparative infrequency of this class of cases is shown by the following table, in which the percentage of wounds inflicted by small arms, artillery, and side arms, is given for four recent wars:

TABLE I.—PERCENTAGE OF WOUNDS BY DIFFERENT ARMS.

WARS.	SMALL ARMS (per cent).	ARTILLERY (per cent).	SIDE ARMS (per cent).
American Civil[1]	90.1	9.8	0.37
Franco-German[2]	94.	4.7	1.3
China-Japan, Third Division, Second Army Corps[3]	90.8	7.6	1.5
Spanish-American (U. S. Regulars)[4]	92.2	7.8	0.0

It may therefore be estimated that considerably more than 90% of all wounds in war are inflicted by rifle bullets. This proportion will vary in different engagements. In siege operations and in attacks on fortifications the percentage of wounds from artillery fire will be above the average, as in the storming of Paris, where 36% of the German loss was from this cause (Rawitz). On the other hand, in general engagements the wounds from artillery fire and side arms will be few and nearly all the casualties will be due to rifle fire, as in the battle of Colenso in the Anglo-Boer war, where 97.5% of the wounds were due to rifle fire and but 2.5% to shell injuries. For this reason consideration of the ballistics of the modern military rifle in relation to the traumatisms produced by it is of the greatest importance.

THE MODERN MILITARY RIFLE.

The modern military rifle is the result of the gradual evolution of firearms which has for its end greater precision, long range, greater penetration, flat trajectory, rapidity of fire, and small weight of ammunition. The result is a class of weapons all of which are practically identical in the particulars above named.

These rifles (Table II.) weigh approximately from 8 to 10 pounds; are of magazine type, carrying from 5 to 12 rounds in the magazine; vary in caliber from 6.5 mm. to 8 mm., and use smokeless powder varying from 1.94 to 2.74 grams for each charge. The projectile is a compound bullet consisting of a lead or hard lead core swaged into a casing of cupro-nickel, or cupro-nickel steel. It (Figure 1: 1, 2) has a caliber of from 6.7 mm. to 8.19 mm.; a length of from 30 mm. to 31.8 mm.; a weight of 10.34 grams to 15.8 grams; and a muzzle velocity of from 1,968 to 2,395 feet per second.

With this weapon and projectile the danger zone has been greatly increased, the range being practically point blank up to

FIG. 1.—Photograph of lodged, undeformed and deformed bullets removed from Spanish-American war cases; natural size. 1. Undeformed Krag-Jorgensen. 2. Undeformed Mauser. 3, 4, 5, 6. Mauser bullets deformed by ricochet. 7. Brass-jacketed Remington, caliber 42. 8. Shrapnel bullet, soft lead.

TABLE II.—BALLISTIC DATA OF THE NEW SMALL-CALIBER RIFLES NOW ADOPTED BY DIFFERENT NATIONS.

ARMY	RIFLE.	BULLET.					Smokeless Powder, grams.	Muzzle Velocity, feet per second.
	Designation.	Cal., mm.	Cal., mm.	Weight grams.	Length mm.	Structure, Core and Casing.		
Austrian	Mannlicher, 1888-1890	8.0	8.19	15.8	31.8	Hard lead, steel case	2.74	2034
British and Canadian	Lee-Metford, 1893, Mark II	7.7	7.89	13.9	31.5	Hard lead, cupro-nickel	1.97	2000
Braxil, Chili, Mexico and Spain	Mauser 1894-1895. 7.0	7.0	7.22	11.3	30.9	Hard lead, cupro-nickel, steel	2.39	2288
Danish	Krag-Jorgensen, 1869	8.0	8.19	15.4	30.0	Lead, cupro-nickel	2.19	1968
French	Lebel, 1886-1893	8.0	8.19	15.0	30.00	Hard lead, cupro-nickel	2.79	2073
German	Mauser, 1888	7.9	8.10	14.7	31.25	Hard lead, cupro-nickel, steel	2.74	2034
Italian	Mannlicher Carcano, 1891	6.5	----	10.5	30.5	Hard lead, cupro-nickel	1.97	2395
Russian	Kapit-Mozen, 1891	7.62	7.79	13.68	30.2	Hard lead, cupro-nickel	1.97	2034
Roumanian	Mannlicher, 1893. 6.5	6.5	6.70	10.34	31.5	Hard lead, cupro-nickel, steel	2.44	2395
Swiss	Schmidt-Rubin, 1889	7.5	8.10	13.7	31.7	Hard lead, steel point, paper jacket	1.94	1968
Turkish	Turkish Mauser, Belgian, 1890	7.65	7.89	13.8	30.8	Lead, cupro-nickel	----	2139
United States	Krag-Jorgensen, modified, 1892	7.62	7.82	14.26	30.63	Hard lead, cupro-nickel, steel	2.09	2000

600 yards, while the weapon is capable of inflicting a mortal wound up to a distance as great as 5,000 yards.

The compound bullet used with this weapon has 4 properties of great importance: (*a*) high velocity; (*b*) great section density; (*c*) cylindro-conoidal form; (*d*) great resistance to deforming violence. These properties combine to give it great penetrating power; while its velocity at the time of impact has a marked effect upon the amount and form of traumatism which it produces in animal tissues, and its velocity and resistance to deformation combined, make it much more liable to ricochet with sufficient violence to produce marked traumatisms even after violent ricochet impact.

Result of the Use of the Modern Small Caliber Rifle.—Upon the adoption of the modern military rifle by different nations, much speculation was indulged in and many experiments were undertaken to determine its effectiveness as a weapon of war and the effect of its projectile upon the human body. Of these it may be said that the experiments of Demosthen[5] and of von Coler and Schjerning[6] upon living animals at actual ranges were the most satisfactory.

But while these experiments gave in part the physical traumatic effects which might be expected of the compound bullet, *the physiologic effects and the results from the standpoint of surgical therapeutics could only be determined by its use in actual war.* These we now have as a result of experience in the Spanish-American war and reports from the Anglo-Boer war, so that we may now consider ourselves in position to act with intelligence and authority in this department of military surgery.

TABLE III.—SHOWING PROPORTION OF KILLED TO WOUNDED.

	Killed.	Wounded.	Ratio.
With old smooth-bore weapons; Blenheim (1704) to Waterloo (1815) 13 great battles.[7]	91.732	222.699	1 to 2.43
With improved rifled breech-loading weapons; Crimea (1866) to Lizaine (1871) 23 great battles.[7]	81.331	322.171	1 to 3.96
With modern small-caliber rifle; Spanish-American War.[8]	.280	1.577	1 to 5.6
Anglo-Boer War up to February 17, 1900.[9]	1.407	5.303	1 to 3.7

Reports from the Anglo-Boer war up to the present writing indicate that the ratio of killed to wounded, 1 to 3.7, is fully equal to that of the older weapons; the average since the adoption of rifled arms being 1 to 3.96. The ratio of killed to wounded was somewhat lower in the Spanish-American war,

being 1 to 5.7, but this was undoubtedly due to the long range at which much of the fighting was done. Different wars, like different battles, will give a different ratio of killed to wounded; the difference being due, not only to the form of weapon used but to the terrain, methods of attack and defense, and many other factors. Thus in the American Civil war the ratio was 1 to 4.7, while in the Turko-Russian war, in which practically similar weapons were used, the ratio in the Russian Army was 1 to 2.01, and in some battles the killed even exceeded the wounded in number. The conclusion reached, therefore, is that *as many deaths upon the battlefield may be expected from the use of the modern small-caliber rifle as from the older fire-arms.*

Far different, however, is the mortality of the wounded. The percentage of the wounded who die has been greatly reduced since the adoption of the small-caliber rifle.

TABLE IV.—NUMBER OF WOUNDED, NUMBER DIED OF WOUNDS, AND PERCENTAGE OF RECOVERIES AND DEATHS AMONG THE WOUNDED IN RECENT WARS.

Nationality.	War.	Wounded.	Died of Wounds.	To 100 of the Wounded.			
				Died.	Recovered.	Ratio.	
English	Crimean War (Matthew)	12,094	1,840	15.2	84.8	1	5.5
French	Crimean War (Chenu)	39,924	4,354	10.9	89.1	1	8.0
French	Italian War (Chenu)	17,054	2,962	17.3	82.7	1	4.7
Federal Troops	Civil War (Otis)	246,712	31,978	12.9	87.1	1	6.7
Prussians	Danish War (Löffler)	2,021	316	15.6	84.4	1	5.4
Prussians	Austrian War (Löffler)	13,731	1,455	10.5	89.5	1	8.6
Germans	Franco-German War (Official)	99,566	11,023	11.0	89.0	1	8.0
Russians	Russo-Turkish War (Official)	56,652	6,824	12.0	88.0	1	7.3
Japanese, Third Division	Chinese War (Haga)	1,105	108	9.7	90.3	1	9.3
Americans	Spanish-American (Official)	1,594	106	8.6	93.4	1	14.1
English	Anglo-Boer[1]	5,303	265	5.0	93.0	1	19.0

[1]Statistics from *British Medical Journal* of March 3, 1900.

This great percentage of recoveries of the wounded is due to two factors: (*a*) the treatment of the wounds by modern aseptic and antiseptic methods; and (*b*) the peculiarities of the traumatisms produced by the small-caliber compound bullet. The wounds produced by this missile are usually either almost im-

mediately fatal or of such character as to make the probability of recovery very great except in the case of wounds of certain regions or organs, as will be pointed out hereafter.

THE TRAUMATISMS PRODUCED BY THE UNDEFORMED COMPOUND BULLET.—The character of the traumatisms from the compound bullet varies with (*a*) the velocity of the bullet at the time of impact, and (*b*) with the structure of the tissues wounded.

With certain tissues, skin, muscle, fascia and adipose tissue, its effect is practically identical at all ranges. It perforates these tissues cleanly and directly, cutting whatever lies in its way, be it artery, vein or nerve. The spongy bones, as those of the face, carpus, metacarpus, and epiphyses of long bones in young subjects, or bones softened by disease, it generally perforates cleanly or with little shattering, at all ranges.

Upon the shafts of long bones or bones composed of compact tissue, upon organs with fluid contents (stomach, intestines, bladder), and organs of spongy texture containing large quantities of fluid (brain, liver, spleen, kidneys), the compound bullet at long range produces its minimum amount of traumatism, *but in these tissues and organs the destructive effect of the bullet increases in proportion to the shortness of the range* until, at about 600 yards and under, it will smash the shaft of a femur or a humerus to fragments,[10] and upon the brain, liver, kidneys, spleen or stomach, unless the latter is empty, will act practically with explosive violence.

From this wide difference in the traumatic effects produced by the compound bullet it is easy to understand why the wounds made by it are so frequently immediately fatal, or, on the other hand, give such excellent opportunity for recovery.

Much has been written of the so-called *explosive effect* of this bullet, and this effect is of the greatest importance. It means simply the results of the lateral transmission of energy imparted to the tissues by the rapidly moving missile. If energy were transmitted only in a line directly in front of a bullet, the bullet would make clean-cut perforations in all organs or tissues through which it passed and immediate fatal results would arise only from direct wounds of bloodvessels, perforations of the heart, or impingement of the bullet upon some vital part of the central nervous system. Lateral transmission of energy, therefore, is a factor of the greatest importance, for the majority of severe traumatisms and immediately fatal effects are due to it.

This transmission of energy to an extent sufficient to cause extensive solutions of continuity occurs to marked extent only in certain organs and tissues and in these only when the velocity of the missile is great.

As this destructive effect occurs only in certain organs and tissues, it must follow that it is because these best transmit the energy imparted by the bullet; and as the structures which transmit this energy with trauma-producing violence are either compact bone or organs containing fluid, or those practically saturated with fluid, it seems most probable that this energy is transmitted in two ways: either through the transmission of vibration by the closely-knit, compact bone-tissue or through the incompressible fluid in fluid-saturated or fluid containing organs. In compact bone, with the missile at high velocity, by the suddenness of the shock, the bone is disrupted, and the osseous particles, acting as secondary missiles, are forced outward, increasing the disruption and traumatism by lateral transmission of the energy imparted.

In fluid-containing organs or fluid-saturated organs, the impact of the bullet when at high velocity is so sudden and violent that its energy is transmitted in all directions by the molecules of the incompressible fluid and disruption in all directions occurs.

With the bullet moving at lower velocity the shock in bone or organ is less, the disruption consequently less, and with still lower velocity the ball may enter and pass through the same tissue or organ with practically no lateral destructive effect. In a broad way the result may be likened to the difference in effect produced by throwing a bullet into water contained in an open leaden vessel or firing it into it. In the first case the bullet will enter, making slight commotion and that mainly upon the surface of the water, while if the bullet is fired into the water, the containing vessel, even though open at the top, will be completely destroyed through the lateral transmission of energy by the incompressible fluid. (Fig. 2.)

FIG. 2.—Showing effect produced by firing into a leaden vessel open at the top and containing water.—Stephenson.[11]

The penetrating and perforating wounds made by the small-caliber bullet are seldom infected.

The aseptic quality of these wounds was noted by Senn[12] in the Cuban campaign, who called attention to the necessity for, and value of, immediate protection of the wound, in order to prevent infection.

Foreign material or pieces of clothing are rarely carried into the wound, and when carried in are usually so small in amount that if they produce suppuration it is generally superficial.

According to Makin[13] the frequency with which portions of clothing are carried into the wound depends considerably upon the material. In khaki, from its hardness, the bullet generally makes a clean slit, but loss of substance from a flannel shirt or the Highland kilt is more common.

Effect of the Compound Bullet on the Soft Parts other than Fluid-containing and Fluid-saturated Organs.—In these tissues, as before stated, the bullet produces but little damage, the lesion being mainly confined to the line of its course. The skin, connective tissues, adipose tissue and muscle, from their loose and open structure and from not being fluid-saturated, transmit lateral impulses but feebly and consequently escape the extensive traumatic effect produced in dense bone and fluid-containing or fluid-saturated organs when the bullet is at high velocity.

The entrance and exit wounds made by the compound bullet are quite small and very similar in appearance. They are generally circular in shape, are usually from 0.75 to 1.25 centimeters in diameter and are usually slightly depressed and covered with a black scab. (Fig. 3.)

In some cases, after a few days, the edges of the wound have the appearance of slight superficial necrosis or infection.[14] When the bullet enters quite obliquely, the wound of entrance is generally oval in outline. In some cases the wound of exit is slightly lacerated or is slit-like, and heals with a scar difficult to detect.[15] With the old, slow-moving lead bullet, the exit wound was generally much larger and much more lacerated than that of entrance, but with the modern compound bullet the wounds are so similar that it is frequently difficult to determine by which the bullet entered. Under an antiseptic dressing the wounds, unless infected, heal within a week or ten days without suppuration.

The course of the bullet and consequently the track of the wound is almost invariably in a straight line. When undeformed, the bullet is rarely deflected from its course, even by bone.

The track of uncomplicated flesh-wounds heals readily, but, according to Makin,[13] the resulting cicatrix in the deeper parts

FIG. 3.—Entrance and exit wounds by Mauser bullets. 1. J. M., Private, 1st Vol. Cav., entrance left cheek ; exit right side of neck ; range 200 yards ; recovery. 2. H. B., Private 6th U. S. Infantry, entrance right breast : exit back, 1 inch to right of spine ; traumatic pneumonia ; recovery. Photographed by E. J. Meyer, Acting Assistant Surgeon, U. S. A., at U. S. A. General Hospital, Fort Monroe, Va., and reported by him to the Surgeon-General, U. S. A.

of the wound is often of extreme density and may produce impairment of the function of a limb by involving tendons or tying the whole thickness of the traversed muscular structures together. This report of Makin is made early after the healing of these wounds and it is probable that in the majority of these cases muscular exercise will cause yielding of the cicatricial bands as it does in cases of subcutaneous cicatricial formation following deep-seated abscesses.

Bloodvessels and nerves are easily cut or severed by the compound bullet. The comparatively slow-moving lead bullet formerly used, frequently shoved these structures aside and passed them without severing or wounding them. With the small-caliber bullet the case is entirely different. From its high velocity this missile does not slip by these structures, but severs, perforates or makes clean-cut lateral wounds. Undoubtedly one of the causes for the immediate high mortality among those struck by the compound bullet is from wounds of bloodvessels. The necessity for the immediate arrest of hemorrhage in wounds of important arteries by the compound bullet is apparent, for from the clean-cut nature of the wounds, bleeding is bound to be rapid and profuse, and first aid upon the firing line should be practiced to the greatest extent possible under the conditions which obtain there. Relative to this proneness of the compound bullet to wound the bloodvessels, Treves,[16] speaking of his experience in the Anglo-Boer war, remarks upon the number of traumatic aneurisms which have come under his observation and states that he has seen aneurisms of this variety of the brachial, femoral, popliteal and posterior tibial arteries, several varicose aneurisms of the thigh and an aneurismal varix in Scarpa's triangle. In a case of large arterio-venous aneurism in Hunter's canal with great swelling of the thigh he placed a temporary ligature on the common femoral, opened the sac, discovered the holes in the artery and vein, and ligated the artery above and below the wound and the vein on the proximal side only. Before the incision was closed the temporary ligature was removed. The case did well.

It is evident that wounds complicated by injury to bloodvessels will frequently have to be dealt with by military surgeons, and that ligation of the vessels under aseptic precautions will be indicated and will be followed by excellent results.

Secondary hemorrhage, however, will be rarely met with, as this complication is so frequently due to infection, a condition which will be much less common than formerly, both from the generally aseptic nature of the wounds made by the modern

bullet and from the fact that infection, when it does occur, is now generally readily controlled by antiseptic methods.

Wounds of the nerves will also be a frequent complication of wounds by the small-caliber bullet as well as will *traumatic neuritis* due to involvement of nerves in resulting cicatrices, or to degenerative changes set up in the nerve by traumatic injury. Dent[17] gives several interesting cases of neuritis which came under his observation in the hospitals at Toynberg, Cape Colony. He relates a case in which pain, hyperesthesia and paralysis led to operative exposure of the ulnar nerve to relieve it from suspected cicatricial involvement, but the cicatricial track of the missile was seen to involve neither the nerve nor any of its branches. He instances other cases in which the nerve was not severed, yet distinct symptoms supervened. He concludes that from the high velocity of the bullet it may entail what the Germans call a violent *Erschuetterung* of the nerve-trunk by passing in its immediate vicinity without directly wounding the nerve, but leading to rapid degenerative change and referred neuritis.

In cases in which the symptoms are due to involvement of a nerve in the cicatrix, operation under aseptic precautions will be indicated, and by liberating the nerve, improvement may follow, as in a case cited by the same writer. Where important nerves are severed they should be sutured by one of the methods used for this purpose, in order if possible to prevent paralysis of the parts distal to the traumatism.

Multiple wounds from the great penetrating power of the small-caliber bullet are common, as for instance the arm and forearm, the elbow being flexed; or the bullet may pass from side through the arm or chest or through both thighs (Fig. 4).

In the case of multiple wounds by the same missile, the second wound of entrance is sometimes larger than the first and is more likely to be slightly infected, probably from infection of the bullet by passing twice through the skin and through several layers of clothing. That the compound bullet does not always become infected in this manner and that it is not extremely liable to become infected under such circumstances, is shown by a case which came under my personal observation, that of Lieut. W. C. S., 6th U. S. Cavalry, in which the bullet passed through the body of a man standing in front of that officer and then passed through his arm and chest. Symptoms of lung-involvement appeared, but there was no infection of any of the wounds and the officer returned to duty in a few days.

EFFECT OF THE COMPOUND BULLET ON BONES.—In fractures of the bones by rifle bullets, the extent of the fracture, its form, and the amount of comminution are governed: (*a*) by

FIG. 4.—Multiple wounds. From photographs by Edward J. Meyer, Acting Assistant Surgeon, U. S. Army. 1. J. A., Private Co. H., 16th Infantry; missile passed through thigh and lodged in penis. 2. J. D., Private, 6th Infantry; multiple wounds both thighs.

the part of the bone struck; (*b*) by the velocity of the missile; and (*c*) by the angle of incidence. As all these factors can hardly be identical in any two cases, bone lesions are bound to vary within certain limits. Of principal importance in these factors is the part of the bone struck, especially when the velocity of the missile is great. The physical qualities of the cancellous tissue of the epiphyses are so different from those of the compact tissue of the shaft of the long bones that, under conditions of violent impact, different traumatic results occur according to whether one or the other of these parts is struck.

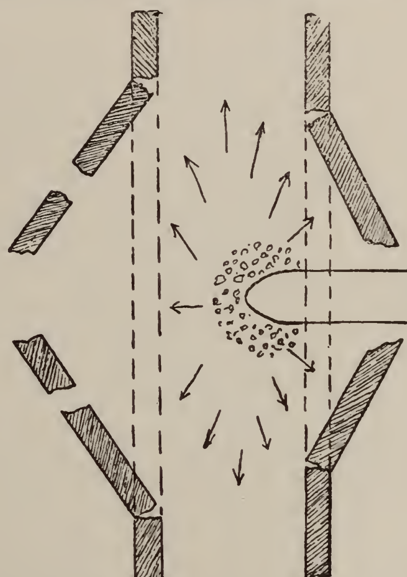


FIG. 5.—Lateral transmission of energy in the shaft of a long bone. Diagrammatic, modified from Beyer. A similar effect is produced in fluid-containing and fluid-saturated organs.

FRACTURES OF THE DIAPHYSES OF LONG BONES.—When the shaft of a bone is struck at short range extensive comminution is produced, whatever the angle at which the bullet may impinge against the bone. The bullet in these cases produces an explosive effect in accordance with the reasons already given. (Fig. 5.)

This effect is not confined to the bone alone; the bone-fragments driven out into the surrounding tissues act as secondary missiles, produce extensive traumatisms of the subcutaneous soft parts and may even be driven out through the wound of

exit and into a neighboring limb. In a case of this sort which came under the observation of the writer, the shaft of the femur was shattered for five inches of its length and largely reduced to bone-sand. The bullet passed through both thigh and leg, and on examining the wound in the latter, bone-sand and several fragments of bone were found which had been carried through the first wound of exit and driven into the second wound of entrance by the force of the missile.

In another case the whole of the distal part of a metacarpal bone was blown out through the exit wound, which was but little larger than usual. (Fig. 6.)

This lateral transmission of energy by compact osseous tissue is so great that a bone may be shattered by a bullet which barely grazes it. This is shown in Fig. 7, from one of my cases. In this case the passage of a Mauser bullet at high velocity across the front of the wrist cut nearly all the flexor tendons and though merely grazing the radius shattered it completely. (Fig. 7.) The same effect is seen in "gutter" wounds of the skull and will be treated of under wounds of the head.

This shattering effect decreases with the velocity of the bullet until it appears only where the angle of incidence is perpendicular to the shaft and the impact of the bullet is median. In cases where these factors are present, marked comminution may occur even when the velocity of the bullet is considerably reduced.

This is illustrated in Fig. 8, which shows comminution of the femur the result of the passage of a bullet directly through it from before backward, the range being something over 600 yards.

At mid range lateral impingement of the bullet generally produces oblique fractures with little comminution, as shown in Fig. 9.

Even at long range the small-caliber bullet usually produces complete fracture of the shaft with some comminution; though this is not always the case, as British surgeons in South Africa report some cases in which the Mauser has even made clean cut perforations of this part of the bone.

Effect of the Small-Caliber Bullet on the Epiphyses of Bones and on Spongy Bones Generally.

In the extremities of long bones, the effect is quite different from that in the shaft. The lateral energy is not so well transmitted, and even at short range extensive comminution is

FIG. 6.—Radiograph showing explosive effect. The distal part of the fourth metacarpal entirely destroyed by a Mauser bullet (short range).

FIG. 7.—Radiograph showing comminution of the radius by a Mauser bullet (high velocity) which barely grazed the bone.

FIG. 58.—Radiograph showing comminuted fracture of femur from median perpendicular impact of bullet; mid-range.

FIG. 9.—Radiograph showing oblique fracture of humerus from lateral impact of bullet; mid-range.

rare. The almost clean perforation made by a Krag-Jorgensen bullet at extremely short range is shown in Fig. 10.

As the shattering effect of the small-caliber bullet upon the articular ends of long bones is usually not great even at short range; at medium and long range, clean perforation, guttering, or fracture without comminution is the rule in those parts of the bone.

The spongy bones of the tarsus and metatarsus and other parts are seldom badly shattered at any range, and perforation without fragmentation is the rule. The bones of the face are almost as invariably perforated as cleanly as are the soft tissues, La Garde[19] having made special note of this as a result of his experience in the Spanish-American war.

Before discussing the wounds of regions, the effect of deformed and deforming small-caliber bullets and lodged missiles and wounds by shell, shrapnel, revolver, saber, and bayonet have to be considered.

WOUNDS BY DEFORMED AND DEFORMING BULLETS.—As before noted, the compound bullet frequently ricochets with great force and though very resistant to deforming violence is often deformed by ricochet impact. (Fig. 1; Nos. 3, 4, 5 and 6.) When deformed it no longer produces typical wounds, but may produce extensive laceration both of the skin and subcutaneous tissues. (Fig. 11.)

Wounds so made have undoubtedly often been attributed to the intentional use of deforming missiles of the dumdum type. These deformed bullets often make wounds so large that they may be thought to have been made by fragments of shell, and even when traveling with low velocity may shatter the shaft of a bone as badly as would the same bullet at short range when undeformed. (Fig. 12.)

Aside from the extensive traumatisms produced by deformed bullets, the gravity of the wounds made by them is greatly increased from the fact that the bullets are usually infected from striking the ground or surrounding objects at ricochet impact; and from their irregular shape are very apt to carry dirt or pieces of clothing into the wound, while the latter is usually so large and ragged that it is easily infected. Similar properties are possessed and similar effects are produced by deforming bullets of the dumdum type.

It follows that *the treatment* of wounds made by deformed or deforming bullets cannot be along the same lines as that adopted in wounds made by undeformed bullets. The ragged nature and infection of the wounds will frequently necessitate active operative treatment—the removal of bone-fragments and

contused and lacerated tissues and treatment by open antiseptic methods. Also amputation of extremities may occasionally be demanded on account of the excessive traumatisms produced, especially if accompanied by infection.

WOUNDS BY SHRAPNEL.—The shrapnel bullet now used is a soft lead bullet measuring 1.25 cm. in diameter and weighing a little over 11 grams (Fig. 1:-8.) The velocity of these bullets is low, being only that of the bursting charge of the shrapnel, and the bullet, therefore, belongs to the large-caliber, low-velocity type. Theoretically wounds produced by these missiles in the soft tissues should differ materially in their character, course of healing, and aseptic quality from those produced by the small-caliber bullet. Practically this is by no means always the case, as in the experience of the writer, of the seven shrapnel wounds seen by him in the Spanish-American war, but three suppurated and in these cases suppuration was the result of the removal of the bullet in the field. In the other four cases the wounds of entrance were so like those made by the small-caliber bullet and irritative symptoms were so lacking that, until the Roentgen-ray was used, the wounds were thought to have been made by small-caliber bullets. This is a strong argument for modern methods. Had these large lead bullets been probed for under septic conditions in the field, instead of being left undisturbed under the impression that they were Mauser bullets, a very different result would probably have been chronicled.

From their low velocity, shrapnel bullets are usually deflected from their course by bones and rarely fracture them. This, however, does not always occur, as a case of clean perforation of the lower end of the femur without fracture, which came under the writer's observation, proved to have been done by one of these missiles—but such cases are undoubtedly rare. Neither is the destructive effect of these missiles upon organs always as great as might be expected from their size, as Treves[16] reports the case of an officer in whom, although a shrapnel bullet passed through both liver and kidney, beyond a little collapse, some temporary tympanites and hematuria, no trouble of any kind appeared.

It therefore appears that wounds made by this missile should be treated along the same lines as those made by the compound bullet.

REVOLVER BULLET WOUNDS.—A small-caliber revolver has recently been adopted in most armies. With this weapon, wounds similar to those made by the small-caliber rifle may be expected, but from the shorter range of the arm and from its being carried only by cavalry, wounds from it will be comparatively few in

FIG. 10.—Radiograph showing perforation of upper end of tibia by a Krag-Jorgensen bullet; range 10 feet. Girard[18] reports a like effect in the lower end of the tibia at short range, and several cases of perforation of the epiphyses occurring in the Spanish-American War have come under my observation.

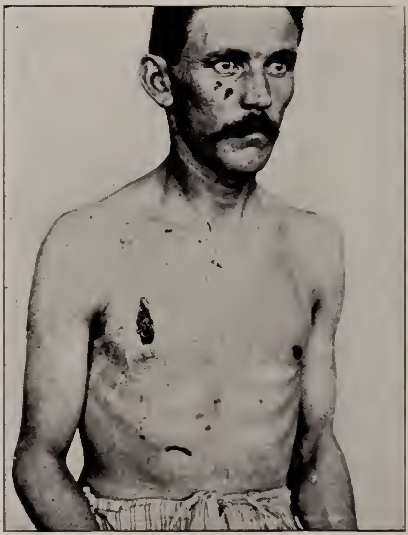


FIG. 11.—Wound by ricochet Mauser. Photograph by Acting Assistant Surgeon Edward J. Meyer, U. S. A. Pvt. A. G. R., 7th U. S. Inf., was bending over rock on which bullet struck and ricocheted making large lacerated wound and fracturing seventh rib. Internal and external hemorrhage from lung. Air escaped through wound. Patient fainted, on recovery stuffed first-aid dressing and handkerchief into wound. Recovery complete at the end of two months.

FIG. 12.—Radiograph showing comminuted fracture of femur by lodged, deformed Mauser bullet. The wound was infected, 11 fragments of bone were removed, and recovery with a shortened but useful limb resulted.

FIG. 14.—Radiograph of Mauser bullet imbedded butt-end foremost in the lower end of the tibia. There was no splintering of the bone, and the bullet was so firmly fixed that much force had to be used to dislodge it.

number. Wounds by the old, large-caliber revolver will be still less frequent and will usually only occur as a result of accident, or homicidal or suicidal intent. The wounds made by this weapon closely resemble those made by the shrapnel ball .

LODGED MISSILES.

RIFLE BULLETS.—The penetrating power of a missile depends upon its velocity, weight, sectional density and form. All these factors are such in the missile projected by the modern rifle as to give it great penetrating power. This is so great, compared to that of the old lead bullet, that while the Springfield lead bullet, caliber 0.45, at three feet from the muzzle will

FIG. 13.—Relative perforating power of the small-caliber rifle bullet in hard oak at three feet from the muzzle.—(La Garde.)

penetrate about three inches of oak, and that with marked deformation, the new bullet will penetrate about nineteen inches of the same wood and remain undeformed. (Fig. 13.)

From its great penetrating power, experimenters argued that lodged missiles would be very infrequent in wars where the small-caliber rifle is used. There are, however, two main factors which determine lodgments of the ball: (*a*) low velocity either from long range or ricochet impact, and (*b*) deformation of the bullet.

The frequency of lodged Mauser bullets in the Santiago campaign has been commented upon by all surgeons who saw the wounded. In 198 Mauser wounds seen by me, there were 21 lodged bullets. On the other hand, in the Anglo-Boer war, reports up to the present (April 1, 1900) show an extreme rarity of lodged balls in the British wounded, though the Boers are using the same arm as did the Spanish. It was thought that the ammunition used by the Spaniards in Cuba was defective; but La Garde, in testing it to determine this point, found no defective shells. Lodgment of the missiles, therefore, must rest mainly upon the conditions under which the engagements are

carried on. In my cases, with few exceptions, all lodged missiles which were removed, were found deformed, indicating that their velocity had been lowered by coming in contact with some obstacle before entering the body (ricochet). In several cases the deformity was so great as to cause surprise that the bullet could have retained sufficient velocity to produce a penetrating wound, and especially to shatter a bone as it did in some instances. (Fig. 12.)

In a number of cases I have seen the lodged bullets were found butt end foremost, showing that the missiles had impinged against some obstacle and turned end for end before entering the part. (Fig. 14.)

It would appear, therefore, that conditions of terrain and the manner in which the fighting is carried on will largely influence the percentage of lodged bullets. In wooded districts and at long range conditions under which much of the fighting was done at Santiago, many lodged missiles may be expected from low velocity due to long range or to impingement of the bullets against trees. Also, when men are in intrenchments or lying prone, bullets may strike the ground or trench before inflicting a wound. On the other hand, in an attacking force in the open—a condition which appears to largely obtain with the British in the Boer war—the percentage of lodged missiles will be small.

With shrapnel, lodgment of the bullets is very common and fragments of shell and secondary missiles are also frequently lodged.

TREATMENT OF LODGED BULLETS.—It is well known that lodged missiles often become encysted in the tissues and cause no trouble. In other cases they produce trouble by inducing suppuration or cause pain or neuritis by pressure upon a nerve, or interfere with motion by implicating a joint. Also, knowledge of their presence sometimes gives rise to mental disquietude even though the bullet is doing no harm. In consequence, the questions for the military surgeon to determine are: (*a*) whether or not to operate for the removal of the foreign body, and (*b*) when the operation should be done. In reply to the first question, the answer is, *that a lodged missile should always be removed when it is producing distressing or dangerous symptoms, if its removal is possible and does not endanger life or necessitate operative traumatisms which will produce effects more serious than will arise from allowing the missile to remain in situ.* It would be manifestly improper to allow a missile which is doing harm to remain in the tissues, provided it could be removed with safety to the patient; and equally, it would be unsurgical

to remove, or attempt to remove, a missile when the operation would be more immediately dangerous or entail greater future dangers or discomforts to the patient than would the presence of the foreign body. In reply to the second question: as to *when* a lodged missile should be removed, the answer is that a *lodged missile should never be removed in the field or in the field hospital unless aseptic technic is available or the danger arising from its presence is greater than that likely to result from the infection which will occur as a result of operating under septic conditions.*

If lodged missiles are removed on the field or at the field hospital, infection nearly always occurs from the almost absolute impossibility of doing aseptic work under the conditions which obtain at the front. If infection occurs, recovery of the patient is delayed and even if no other serious results supervene, the functions of the wounded part are apt to be impaired in consequence of the cicatricial formations which result. Probably no single measure has done so much to increase the gravity of gunshot wounds as the search for and removal of bullets, as was formerly the routine practice in military surgery.

The *probing of bullet wounds* should be entirely abandoned except in cases of urgent necessity. Recent experience has shown that most bullet wounds, even those made by large lead bullets, will generally heal without inflammation or suppuration if left alone. When it is necessary to search for a bullet, the operation should be conducted under conditions of rigid asepsis. But even then, it must be remembered that inflammation may be set up. La Garde and others have shown that while bullets in original packages are usually sterile, this is not the case after they have been handled and carried in the cartridge belt, and that firing infected bullets does not sterilize them. Also Habart, Delorne, and Taulhauber have shown that wounds made by the small-caliber bullet are seldom found free from minute particles of woolen, cotton, or linen fiber carried in from the clothing. All bullet wounds, therefore, may be considered as infected, but not to an extent sufficient to cause inflammation—the natural resistance of the tissues being usually sufficient to overcome the infection present in these cases. If, however, tissue resistance is lowered or recuperative work is interfered with by additional traumatisms either by probes, instruments, or the finger, though these be sterile, inflammation may be set up in wounds which would otherwise go on to uninterrupted healing. For this reason it is usually better to remove a lodged missile through a new opening made directly over it, unless it lies directly in the entrance wound. It is here that the great benefits arise from the

use of the Roentgen-ray, in that it makes possible the localization and removal of lodged missiles without interfering with the original wound.

When a probe has to be used, it should be remembered that, unlike the lead bullet, the steel jacket of the new bullet leaves no stain on the porcelain tip of a Nélaton's probe and that it is, therefore, frequently difficult with a probe to distinguish the bullet from the fragments of bone among which it may be lying. This has been remarked upon by Treves,[10] who points out the advantage of the *telephonic probe* and states that he has used it to advantage in such cases with the wounded of the Anglo-Boer war.

The Roentgen-ray in the Localization of Lodged Missiles.—Immediately upon the discovery of Roentgen radiation, its application to the localization of lodged missiles was recognized and it was used by the British in the Terah and Soudan expeditions. Surgeon-General Sternberg supplied several of the larger military posts in the United States with apparatus, and, upon the outbreak of the Spanish-American war, the principal general hospitals and the hospital ships were furnished with these appliances. Their use has proved so valuable that the British are now using several in the Anglo-Boer war. The use of this apparatus has demonstrated that it is an indispensable diagnostic resource to the military surgeon. (Senn.) By its use, lodged missiles may be located without subjecting the patient to inconvenience, or to danger of infection from probing the wound. In fact, the Roentgen-ray has largely supplanted the probe and should entirely do so except in those rare instances where immediate localization of the bullet is demanded and the Roentgen-ray is not available.

The apparatus for the production of the Roentgen-ray is of two main types, the coil and the static. Both types have been used with success, but are totally unlike in construction.

A coil machine was used by the British in the Terah and Soudan campaigns, and several were in use in the United States army during the war with Spain. In this apparatus, the primary electrical current is supplied either from primary batteries, accumulators, a dynamo, or from a local electrical installation. With the coil apparatus, either a primary battery must be used or the current from a dynamo must be available. The latter is rarely to be had at military hospitals other than those near large cities, but is always available on hospital ships. When a dynamo current can be had, a good coil machine is probably to be preferred to any other kind. In the absence of this source of electrical supply, apparatus operated by batteries gives excellent results.

Battery apparatus has the advantage of being fairly portable and of being capable of installation at any hospital. The best type is that operated by the Edison-Lalande cells, as this battery gives the steadiest output of any primary battery now made.

In the *static machine,* the necessary current is produced directly by the revolution of large circular glass plates. This apparatus has the advantage of requiring no electrical plant or battery. It can be operated by hand, but the work is very tiring and motor power should be used. It gives excellent results, but from its size and weight it is adapted only to permanent hospitals.

The experience of the writer with different types of machines, leads him to the conclusion that the coil type operated by a dynamo is best for hospital-ships and for hospitals where a dynamo current is available, and that for base and general hospitals with no such current, a coil machine operated by Edison-Lalande cells will give the best results with least trouble and expense.

But even the most portable of this apparatus is bulky, heavy, somewhat difficult to transport, and its use requires considerable experience, and at field hospitals necessitates expenditure of time when surgeons are most busy with work incident to active operations. These disadvantages should not be considered were the benefits to be derived from the employment of the apparatus in field hospitals at all in proportion to the difficulties incident to its transportation and use. This, however, is not the case, for the benefits derived from using it at advance hospitals are confined to few, if any, cases, and the time, work, and transportation required for it can be better employed in other ways. This leads to the formation of the opinion that *Roentgen-ray apparatus should not be used at the front or at field hospitals.* This conclusion, in addition to the above reasons, is based upon the following: (*a*) Lodged missiles only in *extremely* rare cases require immediate removal; (*b*) that Roentgen-ray apparatus in the field is an additional incentive to surgeons to operate under conditions not adequately aseptic.

The necessity for noninterference with gunshot wounds at the front or in the field hospital has already been considered This sentiment has been emphasized by no less an authority than von Bergmann; and Kuttner, as a result of his experience in the Greek War, states that its application in the field is very limited and that while it is of great importance for surgical aid in war, it should be installed in fixed hospitals only. In fixed hospitals and on hospital ships it can be properly operated and

managed, and cases requiring its use can be transported to these hospitals and Roentgen-ray observation can there be followed, when necessary, by proper aseptic or antiseptic operative treatment.

This plan of locating and using Roentgen-ray apparatus was exclusively followed in the Spanish-American war and with the best possible results.

Shell Wounds.—Treves, speaking of the British wounded of Spion Kop, says the shell wounds were the most terrible and the most difficult to treat.[10]

Shell wounds differ entirely in character from bullet wounds, and the mistake must not be made of supposing that they can be treated in the same manner. They are made by irregular fragments of metal, are lacerated and unlike bullet wounds are always infected, and if a bone is fractured the comminution is often very great. (Fig. 15.)

The infection present in these wounds necessitates that they be treated on lines of antisepsis rather than asepsis and consequently the same conservatism cannot be practiced as with aseptic bullet wounds. Shell wounds in many ways resemble railroad traumatisms and have to be treated on the lines of general surgical principles. The amount of injury to the soft parts and bone have to be considered in connection with the infection, and active interference rather than conservatism has to be practiced. The thorough employment of antiseptics, with removal of all bone fragments and careful treatment of the lacerated soft parts, will usually be necessary. Amputation will often be required in these cases, much more frequently, certainly, than in bullet traumatisms.

The risks of conservatism in shell wounds involving bones are always great; for as these wounds are always infected the surgeon will have to decide in each case whether the benefits which may be obtained by conservative treatment overbalance the danger to the patient from osteomyelitis, septicemia, prolonged suppuration, and, in bad cases, recovery with a limb at best functionally defective from deep cicatricial formation. It is in this class of wounds that antiseptic methods and operative interferences will come most into play as savers of life or limb.

Saber, Bayonet, and Lance Wounds.—Wounds by these weapons furnish the smallest number of traumatisms received in war. In the Civil war, among the Federal troops but 37-100 of 1 per cent. of all wounds were due to these weapons. In the Franco-Prussian war, among the German troops 1 3-10 per cent., and in the Russian-Turkish war, 99-100 of 1 per cent. were wounded by these weapons.[20]

Unlike the wounds produced by bullets, these traumatisms

FIG. 15.—Showing extensive comminution of lower end of humerus and upper part of ulna. A fragment of shell carried away all the soft parts at the back of the elbow and amputation was necessary.

present no peculiarities which differ from traumatisms frequently received in civil life. Their main characteristics resemble those of wounds inflicted by shells and may be considered in the same class, in that they are generally more or less lacerated, or involve a considerable extent of skin surface and are usually if not invariably infected. For this reason they are to be treated on general surgical principles, and especially by recourse to antiseptic methods.

WOUNDS OF REGIONS.

Aside from the character of wounds, the region of the body in which a wound occurs is an important element in considering its gravity and the prognosis of the case. This is due to the structural peculiarities of different parts of the body and to the presence in certain regions of important or vital structures or organs, injury to which may render a wound of grave importance. For this reason, consideration of the frequency with which different regions of the body are subjected to the traumatisms of war and the comparative mortality of the wounds in each region, is of importance to the military surgeon. In Table 5, statistics relative to these points are given for two wars—the American Civil and the Spanish-American war. Statistics from the Anglo-Boer war will be of great interest as giving more complete conclusions, relative to the effect of modern weapons, than can be arrived at from the statistics of the Spanish-American war, where the wounded were much fewer in number.

WOUNDS OF THE HEAD.

Flesh wounds of the head may be considered of minor importance, as they rarely lead to fatal results. Of the 40 flesh wounds of the head reported in the Spanish-American war, none was fatal; and even in the Civil war, before the adoption of antiseptic methods, but 162 cases were fatal out of 3,496 flesh wounds of this part of the body.

Wounds of the skull or its contents cause a large percentage of deaths upon the battlefield; for in 64 killed in the Santiago campaign, where cause of death was reported, 26 were killed by gunshot of the head. These wounds also cause high mortality of the wounded. (Table V.) These immediately or remotely fatal results arise mainly from injury to the intracranial structures. The cranial contents are injured: (*a*) By direct effect of the missile; (*b*) by secondary injury from injury of the skull. Direct injury to the structures within the skull is due to direct destructive effect of the missile upon the structures through which it passes; and, in the case of bullets at high velocity, to this effect

combined with lateral transmission of its energy (explosive effect). Thus the missile may cause death by striking some vital part of the brain or by severing a bloodvessel. The small-caliber bullet, when at high velocity, undoubtedly produces an explosive effect on the skull and brain. This is due to two factors: (*a*) explosive effect on the skull bones due to the tact that their compact structure readily transmits the energy of the bullet; and (*b*) from the same effect on the brain, which being a fluid-saturated organ, also readily transmits the energy of the bullet, as was pointed out in the discussion of explosive effects. In consequence, there results, at short ranges, a more or less complete disruption of the brain and extensive fragmentation of the skull. The transmission of bullet-energy by the cranial bones is of great importance, for it frequently causes extensive fractures of the inner table of the skull, where the bullet has "guttered" or grazed the outer table only. Particular attention is called to this by Dent,[17] who remarks upon the number of British wounded in the Boer war, in whom the outer table was extensively fractured or splintered. He strongly recommends that every case where the skull is "guttered" or even slightly grazed be trephined, for the reason that injury to the brain is almost sure to have occurred, and states that when this is done the extent of underlying damage has usually excited astonishment. Further, he states that this course of treatment has been followed by excellent results. Treves, in speaking of his experience in the same war, states that, generally speaking, operations upon the skull for gunshot wounds have done exceptionally well, and that such operations have been numerous.[10] In perforating wounds of the skull, the more obliquely the bullet enters, the greater will be the damage to the inner table, and even when the entrance and exit wounds are at right angles to the plane of the skull, the inner table is always more or less broken up at the aperture of entrance (Dent).

In a certain number of cases, however, the small-caliber bullet penetrates or perforates the skull and the brain with little traumatic disturbance and with astonishing immunity to the person wounded. Numerous instances of perforation of the brain have been noted by observers during the Anglo-Boer war and the Spanish-American war. These perforations were not confined to any particular line, but on the contrary were in almost every direction, and yet recovery followed in many instances. Traumatisms of this character are undoubtedly produced by the small-caliber bullet only when at low velocity. They correspond to the perforations made in compact bone, or fluid-saturated organs by that bullet under similar conditions. The tolerance of the brain to the injuries inflicted in this way and even to lodged

TABLE V.—NUMBER, REGIONAL DISTRIBUTION AND MORTALITY OF GUNSHOT WOUNDS IN THE WOUNDED WHO CAME UNDER TREATMENT IN THE AMERICAN CIVIL WAR AND SPANISH-AMERICAN WAR.

Seat and Character of Injury.		Total No. of Cases.		Percent. of Frequency.		Recoveries.	Deaths.	Undetermined Results.	Percent. of Mortality.
	Head:								
Civil War.	Flesh wounds.	7739	12089	3.14	4.9	6573	2676	2840	28.93
	Fractures.	4350		1.76					
Spanish-American War.	Flesh wounds.	40	71	2.86	5.07	51	18	2	26.1
	Fractures.	31		2.21					
	Face:								
Civil War.	Flesh wounds.	4914	9416	1.99	3.82	7406	462	1548	5.87
	Fractures.	4502		1.83					
Spanish-American War.	Flesh wounds.	43	59	3.07	4.21	54	4	1	6.89
	Fractures.	16		1.14					
	Neck:								
Civil War.	Flesh wounds.		4895		1.99	3496	618	781	15.02
Spanish-American War.	Flesh wounds.		35		2.50	26	7	0	21.2
Civil War.	Injuries of spine.		642		0.26	279	349	14	55.59
Spanish-American War.	Injuries of spine.		8		0.57	3	5	0	62.50
	Chest:								
Civil War.	Nonpenetrating.	11995	20264	4.87	8.23	13921	5373	970	27.85
	Penetrating.	8269		3.36					
Spanish-American War.	Nonpenetrating.	61	114	4.36	8.15	99	13	2	11.6
	Penetrating.	53		3.79					
	Abdomen:								
Civil War.	Nonpenetrating.	4748	8438	1.93	3.43	3455	3293	1690	48.80
	Penetrating.	3690		1.50					
Spanish-American War.	Nonpenetrating.	20	64	1.43	4.57	35	29	0	45.31
	Penetrating.	44		3.14					
	Perineum and genital:								
Civil War.	Injuries of pelvis.	1494	3159	0.60	1.27	2194	930	36	29.77
	Flesh wounds of genito-urinary organs.	1665		0.67					
Spanish-American War.	Perineum and genital.		7		0.50	7	0	0	00.0
	Back:								
Civil War.	Flesh wounds of back.		12681		5.15	10883	800	998	6.85
Spanish-American War.	Flesh wounds of back and hips.		108		7.72	106	2	0	1.9
	Upper extremities:								
Civil War.	Flesh wounds.	54801	87793	22.29	35.68	80090	5608	2095	6.54
	Fractures.	32992		13.39					
Spanish-American War.	Flesh wounds.	289	429	20.96	30.66	426	1	2	0.20
	Fractures.	140		10.00					
	Lower extremities:								
Civil War.	Flesh wounds.	59139	86413	24.06	35.13	73665	11813	935	13.82
	Fractures.	27274		11.09					
Spanish-American War.	Flesh wounds.	354	504	25.30	36.02	499	8	6	1.60
	Fractures.	150		10.72					

bullets is sometimes remarkable. This is instanced in a case reported by Girard and published by Forwood.[7] (Fig. 16.)

These wounds of the brain and similar ones of the abdomen have produced the greatest surprise and have been the most commented upon by military surgeons. They really, however, furnish only a small minority of cases and their remarkable character, rather than their frequency or importance as factors in accounting for a lowered mortality of the wounded, is the reason for the great interest they have excited.

It has been shown by Table II that the mortality of the wounded has been greatly decreased in recent wars.

Large caliber rifle used:
Civil War.
Federal troops, of the wounded, 6.7 recoveries to 1 death.
Franco-Prussian War.
German troops, of the wounded, 8 recoveries to 1 death.

Small caliber rifle used:
Spanish-American War.
American troops, of the wounded, 14.1 recoveries to 1 death.
Anglo-Boer War.
British troops, of the wounded, 19 recoveries to 1 death.
(Up to January 27, 1900.)

The question arises as to whether the decreased mortality of the wounded in war since the adoption of the small-caliber rifle is in any part due to a decreased mortality among those of the wounded who have sustained injuries involving the skull or brain. Statistics on this point from the Anglo-Boer war are not available, but the statistics of the *Spanish-American war show practically as high a mortality of the wounded who received skull or brain injuries as has occurred since the Crimean War.* (Table VI.)

TABLE VI.—NUMBER OF CASES OF WOUNDS OF THE HEAD INVOLVING THE SKULL OR ITS CONTENTS, AND THE MORTALITY IN THIS CLASS OF WOUNDS.

	Number.	Died.	Percentage of Deaths.
Crimean War—English	230	170	73.9
Crimean War—French	440	546	73.8
Italian War—French	258	119	46.1
Civil War—Union forces	4,022	2,459	61.2
Franco-Prussian War—Prussian troops	1,527	783	51.3
Spanish-American War—American troops	31	18	58.4
Average mortality	----	----	60.7

FIG. 16.—Photograph and radiograph of Private J. G., 1st Neb. Vol. Mauser bullet entered above left eye and lodged in brain to left of median line. Recovery with no paralysis. Photograph taken 15 months after receipt of injury.

From this it may be stated that *notwithstanding the advantages of modern surgery the greater destructive effect of the small-caliber rifle has maintained the gravity and fatality of wounds of the skull and brain.* It may be that full statistics of the Anglo-Boer war will modify this statement to some extent, but the statistics show that the occasional occurrences of recovery after gunshot wound of the skull or brain should not blind the military surgeon to the extreme gravity of these cases.

Wounds of the Face.—Wounds of this region gave a mortality of 5.8 per cent., the lowest regional mortality in the Civil war; while in the Spanish-American war they gave a mortality of 6.7 per cent., being more fatal even than in the Civil war and much more fatal than wounds of the extremities. (Table V.) This grave nature of wounds of the face is rather surprising, and seems to indicate that the wounds of this region by the small-caliber bullet are not so benign as might be expected from the apparent immunity with which the face is pierced in some instances, of which the case in Fig. 3 is an example. The septic condition of the nasal cavities and mouth, and the proximity of the brain are the factors of danger in these cases, for of the four deaths which resulted from wounds of this region in the Spanish-American war, two were from septicemia and two from meningitis.

Wounds of the Neck.—Wounds of this region are probably frequently immediately fatal from injury to the great vessels, and wounds of important nerves and structures may add to the gravity of the traumatisms even when death is not immediate. This is shown by the fact that in the 35 reported cases in the Spanish-American war, there were 7 deaths, a mortality of 20 per cent., while in the Civil War, wounds of the same region gave a mortality of 15 per cent. Thus in this region as with the head, statistics show a mortality at variance with the impression made by seeing numerous cases of bullet perforations of the neck with apparently little bad effect. As no wounds of the spine are recorded in this class and as flesh wounds by the small-caliber bullet are notoriously aseptic, the bad results must be entirely due to severe traumatisms of important structures in the neck; and, as the mortality reported is high, even though the total number recorded is small, it may be concluded that *the use of the small-caliber rifle has not decreased the mortality in wounds of the neck.*

Wounds of the Spine.—Wounds of this region are rare, forming but one-fourth to one-half per cent. of all cases. (Table V.) They are, however, extremely fatal, as they give the highest percentage of mortality of the wounded of any class of wounds.

Civil War	55.5
Franco-Prussian War (Germans)	67.7
Spanish-American War (U. S. Reg.)	62.5

The causes of death in gunshot wounds of the spine are: (*a*) direct injury to the cord by the missile; (*b*) hemorrhage from severance of spinal bloodvessels; (*c*) spinal meningitis; (*d*) myelitis or degeneration; (*e*) degeneration of the kidneys and cystitis from trophic lesions of the urinary organs; (*f*) exhaustion from bedsores. When the spinal substance is injured the mortality is always very high, as Otis states that the spinal injuries during the Civil War followed by recovery were exclusively those in which the osseous structure of the spine only was involved. Like the traumatic effect upon the brain, traumatism of the spine by the small-caliber bullet is of a very serious character. Dent, in speaking of this class of injuries in the Anglo-Boer war, says that no cases in hospital seem more hopeless or more distressing.[17] He remarks upon the astonishing rapidity of the degenerative changes which occur—deep sloughing bedsores forming in a day or two and cystitis setting in early. He says that if there is any grave lesion of the cord the wound may be set down as mortal even when the wound affects but a small portion of the cord. Even when the traumatism is small, the bullet possibly having barely grazed the cord, the area of damage may be very great. This extensive injury to the cord is undoubtedly due to the fact that it is fluid-saturated, and therefore, like other similarly saturated organs, transmits the energy of a high-velocity missile with lateral explosive violence. It also appears (Table V.) that a larger percentage of injuries of the spine will occur from the use of the new rifle, the percentage of occurrences in the Spanish-American war being double that of the Civil war (0.26 to 0.54). This is to be expected; for, from the greater penetrating power of the new bullet, a protected part like the spine is more liable to be reached.

From this it appears that the use of the small-caliber rifle has certainly not decreased the gravity and has increased the frequency of wounds of this class. The number of wounds of the spine in the Spanish-American war was small. There were but eight such wounds reported, but of this number five died. While this number is hardly sufficient for more than very general statistical conclusions, it certainly points to the extreme fatality of this class of wounds and appears to demonstrate that notwithstanding the resources of modern surgery, the destructive effect of the small-caliber bullet upon the spine is so great as to make the percentage of recovery in this class of wounds extremely low. The conclusion reached, therefore, is that *use of the small-*

caliber bullet has not diminished the gravity of wounds of the spine, and has increased the mortality of the wounded by increasing the number of wounds of this class.

The *treatment* of gunshot wounds of the spine should be carried out only under the strictest aseptic precautions. If suppuration occurs it certainly leads to fatal spinal meningitis and myelitis. Operative treatment, therefore, can be recommended in these cases only where aseptic technic can be employed. This is rarely the case in the field hospitals, but at base and general hospitals where means are available, operative measures should be instituted in all appropriate cases. Under such conditions formal or informal laminectomy should be done, and all bone-splinters and depressed bone removed in order to relieve the cord from pressure or irritation.

The complications arising in these cases, such as cystitis and bedsores, should be treated on the general principles of surgery, and every possible means should be used to prevent their occurrence.

Wounds of the Chest.—Wounds of the chest furnish about 8 per cent. of all wounds received in war, ranking next to wounds of the extremities in order of frequency. (Table V.) Wounds of this region probably furnish a large proportion of immediately fatal results from injury to the heart or great vessels, as in 64 deaths in the Spanish-American war, the causes of which were reported, 17 were due to penetrating wounds of the chest.

Wounds of this region are divided into nonpenetrating and penetrating, according to whether the chest-wall only is involved or whether the pleural cavity has been entered with or without injury to the chest-contents. This division is a most important one from a standpoint of prognosis; for while the mortality in penetrating wounds is very high, but few nonpenetrating wounds prove fatal, even though the ribs may be involved, and are generally dangerous only when the destruction of tissue is extensive —as is sometimes the case with shell-wounds—or from extension of infection to the pleura when the wound is infected. With the resources of modern antisepsis these dangers are mainly done away with, and nonpenetrating wounds of the chest will probably sink into insignificance as mortality-producing factors. In the American Civil war, 3.2 per cent. (Otis) of all such cases were fatal, while in 61 such cases occurring in the Spanish-American war, there were no deaths.

Penetrating wounds of the chest are much graver injuries.

TABLE VII.—SHOWING PERCENTAGE OF MORTALITY IN PENETRATING WOUNDS OF THE CHEST.

	Per Cent.
French in Crimea (Chenu)	91.6
English in Crimea (Matthew)	79.2
French in Italy (Chenu)	46.48
Civil War (Otis)	62.66
Prussian in Schleswig (1864) (Loeffler)	41.6
Danish in Schleswig (Loeffler)	67.2
Germans in Franco-Prussian War (Fischer)	56.7
Japanese in Chinese War (46 cases) (Haga)	34.7
Spanish-American War (American Regulars) (Official)	24.5

In the Spanish-American war, 58 cases of penetrating wounds of the chest were reported, with 13 deaths (24.5 per cent). By this it will be seen that the mortality in this class of cases is distinctly lower than in former wars when a large bullet was used. (Table VII.) All observers have remarked upon the immunity with which in many cases the chest is penetrated or perforated by the small-caliber bullet. This was remarked upon by Senn at Santiago and by Treves in South Africa, who state that there were often no symptoms in these cases beyond an immediate hemoptysis, which was not repeated. The lower mortality in recent wars is probably mainly due to the character of the wounds made by the small-caliber bullet. From the aseptic nature of these wounds, infection, when it occurs, is probably usually due to infection from the lung rather than from the external wound. Notwithstanding the favorable course of many cases, it should be noted that wounds of the chest are of grave import and should by no means be treated lightly. This is shown by the fact that in the Spanish-American war, practically one-fourth of those wounded died. Greenleaf has called attention to the gravity of these cases, and has shown that serious complications are by no means uncommon.[21] In 24 cases of gunshot wounds of the chest which he collected from the Spanish-American war records, 9, or 37 per cent. developed complications; 3 had hemothorax, and 6 developed hemothorax which became purulent and required operation. From these cases he argues that gunshot wounds of the chest by the small-caliber bullet are not of as light a nature as was supposed and that care should be taken in treating them. Treves, in speaking of similar wounds in the Anglo-Boer war, says that he has seen surgical emphysema, hemothorax, pneumothorax, and an example or two of

empyema, but that, on the whole, gunshot wounds of the chest do well.

Aside from lowered mortality due to the small-caliber bullet, the *treatment* adopted has undoubtedly had much to do with reducing the number of deaths in these cases. It should be directed; (*a*) to immediate care of the wound; (*b*) to the complications which may arise.

The primary use of protective dressings will often prevent subsequent infection of the wound, or pleura, with possibly resulting empyema. The serious complications which may follow are: (*a*) hemorrhage; (*b*) hemothorax; (*c*) pneumothorax; (*d*) empyema; (*e*) pleurisy or pneumonia; (*f*) abscess of the lung.

Hemorrhage is of course to be treated by ligation, or pressure by Desault's plan when the ligation is impracticable. Hemothorax being the result of hemorrhage, the bleeding should, if possible, be controlled by ligature; or if it occurs from the lungs, sedatives, cold applications, and absolute rest should be tried. These failing and the case being urgent the clots should be turned out and ice-water should be injected into the pleural cavity as recommended by Delorme. Where the bleeding has stopped and operation is required, tapping and evacuation by syphonage, as recommended by Senn, should be employed.

Empyema should be treated by free drainage, daily irrigation with warm antiseptic solution and final resort to Estlander's operation if necessary. Abscesses of the lung should be evacuated and treated on similar lines. The surgery of the lungs and pleura has made great advances of late years and adoption of the methods now in vogue will do much to lessen the mortality in complications arising from gunshot and other traumatisms involving the pleural cavity or the thoracic contents.

From this and the statistics available, it may be stated that the *use of the small-caliber rifle has lowered the mortality in penetrating wounds of the chest and that modern surgical methods have also been a decided factor in this direction.*

WOUNDS OF THE ABDOMEN.—Wounds of the abdomen, like those of the chest, are divided into nonpenetrating and penetrating. *Nonpenetrating* wounds of this region, like similar ones of the chest, are of minor importance.

Penetrating Wounds of the Abdomen.—These wounds cause a large proportion of immediate deaths on the field of battle.

In 64 deaths from gunshot in action in the Spanish-American war, in which the cause of death was reported, 19 were due to wounds of the abdomen. These immediate deaths were undoubtedly due: (*a*) to hemorrhage from wound of some blood-vessel; (*b*) to hemorrhage and shock from wound of some one

of the large intra-abdominal organs. These organs—liver, spleen, kidneys—are blood-saturated organs, and at short range the compound bullet often acts upon them with destructive violence. Also, the stomach or bladder, if filled with fluid, may be extensively torn or ruptured. This is due to the violent transmission of energy in all directions from the rapidly moving bullet by the incompressible fluid in fluid-filled or fluid-saturated organs, as was pointed out in the discussion of explosive effect. In these cases extensive laceration and disruption of the organs occur with consequent hemorrhage and shock, which immediately or quickly cause death.

At long range and lower velocities the bullet may simply perforate these organs and recovery take place with few symptoms. Numerous cases of this kind have been reported by surgeons in both the Spanish-American and Anglo-Boer wars, and have been as much commented upon as have similar wounds of the skull or brain.

No class of cases, however, have been so tremendously fatal in war as penetrating wounds of the abdomen, and they still show the highest mortality of wounds of any region. (Table VIII.)

TABLE VIII—MORTALITY FROM PENETRATING WOUNDS OF THE ABDOMEN.

	Number.	Died.	Mortality.
Crimean War—English	120	111	92.5
Crimean War—French	121	111	91.7
Italian War—French	246	163	87.2
Civil War—Federals	3,717	3,031	87.2
Danish War—Prussians	103	59	57.2
Danish War—Danes	89	57	64.
Franco-Prussian War (Fischer)	1,047	784	74.8
Japan-China War (Haga)	47	33	70.2
Spanish-American War (U. S. Regulars)	44	29	65.0
Average mortality	----	----	74.3

These figures show an average mortality, previous to the Spanish-American war, of practically 75 per cent. This seems to indicate that the mortality in these cases has been somewhat lowered by the use of the new rifle. The gain would be more evident if it were not for the figures of the Italian war and the Danish war, in both of which, though large-caliber bullets were used, the mortality was lower than in the Spanish-American war. Taking the other wars into account, there is a decided

improvement in the mortality, the decrease as compared with our Civil war being over 20 per cent.

In considering the statistics of the Spanish-American war, the factor of treatment should be taken into account.

Penetrating wounds of the abdomen (U. S. Regulars), 44.
Laparotomies for these wounds, 4; deaths, 4; Mortality, 100%.
Cases not operated on, 40; deaths, 25; mortality, 62.5%.

The statistics from the Spanish-American war for these cases are small, and it may be that the larger figures which we shall have from the Anglo-Boer war will still further emphasize the comparatively humane effect of the small-caliber bullet and the good results of conservatism in penetrating gunshot of the abdomen. The large percentage of deaths in these cases is due to septic peritonitis, but with the small bullet there is less danger of infection from the exterior or from fecal extravasation than with the large bullet. From the usually aseptic nature of the wounds made by the small bullet, it may be presumed that peritoneal infection only exceptionally occurs by way of the surface of the body. Infection, when it does occur, must therefore usually be due to extravasation from wounds of the intestinal canal. Undoubtedly there are a number of cases in which intestinal perforation occurs and peritonitis does not result, for both Treves and MacCormac report such cases among the British wounded in South Africa. MacCormac suggests that it is due to an empty alimentary tract and the rapid closing of the small perforation made by the bullet, and Treves suggests that the small hole may be closed by apposition with an adjacent coil of intestine. In an empty intestine or stomach, the small-caliber bullet probably produces as small a hole as it does in other soft tissues, and the contraction of the tissues tends to close the small opening, while adhesion to an adjacent intestine may readily occur. Also, a certain number of penetrating wounds occur in which the intestines or intra-abdominal organs are not injured. These conditions all aid to lessen the gravity and mortality of wounds of this region.

To summarize, it may be concluded that modern surgical methods have not as yet proved available to markedly reduce the mortality of the wounded in penetrating wounds of the abdomen received in war; but, that the mortality in these cases has been lowered to some extent by the use of the small-caliber rifle.

Wounds of the pelvis and genito-urinary organs taken together, in the Civil war had the high mortality of 29.7 per cent. In the Spanish-American war no cases of wounds of the pelvis

were reported, but there were seven wounds of the perineum and genito-urinary organs with no deaths. Wounds of the pelvis depend largely for their gravity upon whether or not the pelvic contents are injured. If the pelvic peritoneum is involved the wounds belong to the same class as penetrating wounds of the abdomen and the mortality from them and the treatment indicated are practically similar.

Wounds of the pelvis proper by the small-caliber bullet will not be as grave as in former wars. The osseous structure of the pelvis is spongy and will not be as greatly shattered by the small-caliber bullet as by the larger bullet formerly used, while the aseptic nature of the wounds made by the new bullet and the antiseptic treatment now adopted for lacerated and infected wounds made by other missiles will tend greatly to lower the mortality in cases where the extraperitoneal structures only are involved.

Wounds of the bladder are dangerous from the extravasation of urine into the tissues, or its escape into the peritoneum if that cavity is wounded. With the new bullet it is possible that the bladder may be pierced and no bad results follow, but in some cases active treatment will be required. Operative *treatment* at the field hospital is not to be recommended except in extremely urgent cases, and especially not if the peritoneum is involved. If the peritoneum is opened by operation the chances for recovery will be as infinitesimal as in laparotomy for abdominal penetrations. Operations, not involving the peritoneum, may be attempted where immediate interference is necessary, but all cases in which delay is possible should be transported to base hospitals where proper technic is available. When required, a catheter should be introduced and retained in the bladder, and other palliative treatment adopted until operation can be done with safety.

WOUNDS OF THE EXTREMITIES.

It is in the wounds of these regions that the use of the small-caliber rifle and modern surgical methods have produced the great saving of life and limb. Wounds of other regions of the body, as already shown, present but a moderate reduction in fatality. But wounds of the upper and lower extremities have been surprisingly less fatal in wars where the small-caliber bullet has been used and where the wounds have been treated by aseptic and antiseptic means and by the expectant and conservative treatment which is a natural concomitant of these methods. (Table IX.)

TABLE IX.—NUMBER OF CASES AND MORTALITY FROM GUNSHOT OF THE EXTREMITIES IN THE CIVIL WAR AND SPANISH-AMERICAN WAR (U. S. REGULARS).

	Cases.	Died.	Mortality.
Civil War .... Upper extremities.	87,793	5,608	6.5
Spanish-American War -- Upper extremities.	429	1	0.2
Civil War .... Lower extremities.	73,665	11,813	13.8
Spanish-American War -- Lower extremities.	562	9	1.6

Thus in the Civil war, while the mortality of all wounds of the extremities, upper and lower, was from 6.5 per cent. to 13.8 per cent, similar wounds in the Spanish-American war had a total mortality of but 1 per cent. The number of deaths in the latter war from wounds of these regions is surprisingly small, but 10 in 991 cases; and of these 10 cases, 3 died very shortly after the receipt of their injuries, probably from hemorrhage.[4] The difference in treatment adopted in these wars is not less great than the mortality. (Table X.)

TABLE X.—WOUNDS OF THE EXTREMITIES TREATED BY EXCISION AND AMPUTATION, AND BY CONSERVATISM, AND THE RELATIVE MORTALITY OF EACH TREATMENT FOR TWO WARS.

War.	Wounds of Extremities.		Amputations and Excisions.		Percentage of Operations to Wounds.	Operative Mortality.	Conservative Mortality.
	Total.	Deaths.	Total.	Deaths.			
Civil	174,206	17,421	12,193	2,636	6.99	21.4	9.1
Spanish-American	991	10	32	6	3.20	18.7	0.4

This table shows at once: (*a*) The small number of operations done or required to be done in wounds of the extremities since the adoption of the new rifle and modern surgical methods, the proportion having been *reduced over one-half* (6.99 to 3.20); (*b*) the great decrease in mortality in these cases, the mortality being *reduced over twenty-two times* in cases treated conservatively (9.1 to 0.4), and somewhat decreased in those treated by amputation or excision.

The high mortality in operation cases makes it probable that only the extremely serious cases were operated on. In the Spanish-American war in the cases reported among the regulars, the deaths that occurred were all from high amputations. (Table XI.)

TABLE XI—RESECTIONS AND AMPUTATIONS AND DEATHS FROM THESE OPERATIONS IN THE SPANISH-AMERICAN WAR (REGULAR TROOPS).

	Resections.	Amputations.	Deaths.
Arm	1	4	1
Forearm	1	2	0
In hand	0	13	0
Hip joint	0	2	2
Thigh	1	5	2
Knee	0	1	1
Leg	0	1	0
Ankle	0	1	0
Total	3	29	6

No deaths from resection.

From this it may be formulated that the use of *the small-caliber rifle and modern surgical methods have together greatly reduced the loss of life and limb in gunshot wounds of the extremities.*

Having considered wounds of the extremities in general, it remains to study wounds of the joints and bones, wounds of the soft parts having been sufficiently discussed under the general heading of wounds.

Wounds of the Joints.—In no department of military surgery has the treatment of wounds been so greatly changed and for the better as in gunshot wounds involving the joints. From radical operative interference usually by amputation above the wounded joint, treatment has changed to expectant and conservative lines, and with a result in saving of life and limb which is truly astonishing. The credit for inaugurating this change is due to von Bergmann, whose brilliant results in the Russian-Turkish war with wounds of the knee-joint treated by occlusive and antiseptic dressings and immobilization, inaugurated a new era in military surgical treatment in joint wounds.[22]

In the battle of Gorne Dubrik, von Bergmann selected 15 of the most serious cases of gunshot of the knee in which, aside from the implication of the joint, there was extensive comminution of the bone. In these cases treated by the above method, perfect recovery resulted, with but a single exception, notwithstanding the fact that the patients were exposed for days to pouring rain and had to be transported across the plains over muddy roads. In the same war, of other cases treated by the older methods then in vogue, 95 per cent. died.

In considering von Bergmann's brilliant results, it must be borne in mind that the wounds treated were made by the large

lead bullet then used, and that the results must be attributed to the treatment rather than to any effect of the missile.

TABLE XII.—MORTALITY OF WOUNDS OF THE JOINTS IN FOUR WARS.

Joint.	American Civil War.	Franco-Prussian.	Japan-China (Haga).	Spanish-American (Regulars).
Hip	84.7	71.8	100.0	0.00
Knee	53.7	48.9	25.0	5.5
Ankle	26.9	24.0	0.0	0.0
Shoulder	31.1	35.5	0.0	0.0
Elbow	19.4	21.2	0.0	0.0
Wrist	12.9	12.6	0.0	0.0

The same line of treatment was adopted by Haga[3] in the Japan-China war and by our surgeons in the Spanish-American war. The excellent results obtained as well as the comparatively tremendous mortality in previous wars is shown in Table XII. In this connection, Table XIII. is also very valuable and interesting as it shows that the deaths from joint-injuries in two wars since the adoption of aseptic and antiseptic methods and expectant treatment have all been from wounds of the larger joints.

The four deaths reported by Haga were from wounds of the hip and knee, and the *single death from joint-wound in the Spanish-American war among the United States Regulars was due to a gunshot of the knee treated by amputation.*

TABLE XIII.—CASES AND DEATHS IN EACH CLASS OF JOINT-WOUNDS IN TWO RECENT WARS.

	JAPAN-CHINA WAR. (Haga).		SPANISH-AMERICAN WAR. (Regulars).	
	Number.	Deaths.	Number.	Deaths.
Hip	1	1	0	0
Knee	16	4	18	1
Ankle	4	0	11	0
Shoulder	4	0	3	0
Elbow	16	0	5	0
Wrist	6	0	6	0
Total	47	5	43	1
	Mortality ---- 10.6%		Mortality ----- 2.3%	

Operation was done in but 2 of the 43 Spanish-American war cases. These were both amputations, one for gunshot of the ankle-joint and one of the thigh for gunshot of the knee-joint, the latter amputation as just noted giving the only fatal result which followed gunshot of the joints in the regular troops during the Spanish-American war.

In the Civil war, gunshot of the knee-joint, next to wounds of the skull, brain, spinal cord, and abdomen, gave the highest mortality of any class of wounds—approximately one-half of those wounded died—while in the 38 cases of Table XIII., there are but 5 deaths, or less than 1 death in 7, and in the American cases there is but 1 death in 18 cases and that followed operation. No stronger argument could be adduced for conservatism in *bullet* wounds of the joints. The conditions are practically identical with those present in penetrating abdominal wounds, for in each there is the probability of an aseptic wound which may be made septic by operation, especially if the operation is attempted at the field hospital. The rule of conservatism should be as firmly adhered to in one case as in the other. In civil practice, with all the technic of asepsis, the surgeon may when necessary open a joint as fearlessly as he would the abdomen; but in military practice, in view of the high mortality from operation and the almost certainty of cure by conservatism, the military surgeon should open joints or amputate only when the life of the patient is in imminent peril. The surgeon will be aided along conservative lines by the fact that the small-caliber bullet, except at very short range, rarely fragments the articular ends of bones to marked extent. The bullet in many cases may pass through joints and simply perforate or but slightly fissure the bones. Considering this in its relation to conservative treatment it should be remembered that septic infection more frequently produces anchylosis and impaired function of a joint than does bone-displacement, unless the displacement is marked; and that septic infection of a large joint is a great menace to life.

But in some cases operative interference will be demanded. This necessity will most ordinarily arise from extensive traumatisms, from shells or deformed ricochet bullets, or from infection of the wounds. In such cases the operation which will best serve will have to be determined for each individual case, taking into consideration that in a choice between excision and amputation some general rules have been found to best apply for wounds of certain parts. Thus, in general terms, it may be stated that where bone and tissue destruction is not too great, military surgical experience has shown that excision is to be preferred to amputation in all joints except the knee and ankle. With aseptic

and antiseptic technic available, it is possible that more excellent results may be obtained in excision of these joints in the future than have been had in the past, but as yet a sufficient number of cases is not recorded from which to draw conclusions.

In summarizing conclusions relative to joint wounds it may be stated that *the mortality in joint wounds has been remarkably diminished by the adoption of aseptic, antiseptic, and conservative methods and by the use of the small-caliber rifle.*

Gunshot Fractures of the Extremities.—The effect of the small-caliber bullet upon the long bones has already been discussed; it remains to study the treatment of these traumatisms. It may be said at once that the treatment adopted in compound fracture by gunshot has as radically changed, and that for the better, as has the treatment of gunshot of the joints. (Table XIV.)

TABLE XIV.—COMPARATIVE MORTALITY OF COMPOUND FRACTURES IN THE CIVIL AND SPANISH-AMERICAN WARS ACCORDING TO TREATMENT ADOPTED.

	MORTALITY, CIVIL WAR.		MORTALITY, SPANISH-AMERICAN WAR.	
	Treated Conservatively.	Treated by Amputation or Excision.	Treated Conservatively.	Treated by Amputation or Excision.
Arm	14.3	26.0	0.0	20.00*
Forearm	6.4	13.9	0.0	0.0
Thigh	49.19	62.4	0.0	57.1*
Leg	13.8	30.5	0.0	0.0

*One operation only.

From this table it will be seen that as with the joint wounds, conservatism is made possible in gunshot fractures by the aseptic nature of the wounds made by the small-caliber bullet and that, aided by aseptic methods, conservatism has reduced the mortality in these cases to an extent almost beyond belief. The gravity of compound fractures depends mainly upon the presence or absence of infection, and where this can be excluded or prevented, traumatisms of the bones heal as well as traumatisms of other tissues. In the Spanish-American War 100 gunshot fractures of the extremities, exclusive of the foot and hand, were reported among the U. S. regulars. In these 100 cases there were but 5 deaths and these only in cases operated on. (Table XV.)

TABLE XV.—CASES, OPERATIONS AND DEATHS FROM COMPOUND FRACTURES OF EXTREMITIES, U. S. REGULARS, SPANISH-AMERICAN WAR.

	Cases.	Died.	Resections.	Amputations.	Deaths From Amputations.
Arm	18	1	1	4	1
Forearm	26	0	1	2	0
Thigh	30	4	1	6	4
Leg	26	0	0	1	0
Total	100	5	3	13	5

Mortality in all cases .... 5 %
Operative mortality 31.2%
Conservative treatment mortality 0.0%

It is to be noticed that the deaths all occurred after high amputations, 2 being amputations at the hip-joint of which both died; 2 amputations in the middle third of the thigh with 1 death; and 2 amputations in the lower third with 1 death. The death from amputation of the arm was in a case operated on at a dressing station, death occurring 18 days later, probably the result of infection due to operation in septic surroundings. The results tabulated in the tables given show most emphatically that conservation should be practiced in all cases possible.

When *operative measures* have to be adopted the question of excision or amputation will arise.

Excision in the shaft of the long bones has been unfavorably considered by military surgeons in the past. The mortality from this operation has been greater than that from amputation, and the functional use of the part has, as a rule, not been good. It is to be noted, however, that the large statistics now available are from wars in which aseptic and antiseptic methods were unknown and that in recent wars operations have been too few to warrant conclusions. It would seem that with the resources of antisepsis and asepsis that limbs could be saved in many cases by recourse to excision and without greater danger than is entailed by amputation.

The reduced though still high mortality from amputations shown by Table XV., like the high mortality from amputation for joint-wounds, is undoubtedly due to these operations being done only on the worst cases. Amputations and excisions will of course still be necessary in gunshot fractures when destruction of the soft parts is great, when the main vessels of the part

are severed and when infection, if present, cannot be controlled. The rule, however, is conservatism in these cases; the results from this line of treatment and the decreased mortality in gunshot of the bones of the extremities being such that it may be formulated: *the use of the small-caliber rifle and modern surgical methods have, together, greatly reduced the mortality in gunshot fracture of the extremities.*

General Conclusions.—In reviewing the foregoing it may be safely stated that the facts and figures show that the military weapon now used in war which inflicts the great majority of wounds, *i. e.,* the small-caliber rifle, together with the surgical methods now in vogue, have materially affected the practice of military surgery. Operative measures once thought imperative are now no longer required. The aseptic character of the wounds made by the small-caliber bullet allows conservatism in many cases where radical measures were formerly necessary, while the traumatism produced by it in many cases, and in certain regions of the body, is directly conducive to a minimum of evil result. At the same time the effect of the bullet in other regions is such that the mortality of the wounded has not been greatly diminished.

Relative to the use of the small-caliber rifle it may be stated:

1. That the small-caliber rifle is *not* a humane weapon so far as its immediate death-dealing power is concerned.

This is proved by the statistics which show that the proportion of killed to wounded has, if anything, been increased by its use.

2. That it *is* a humane weapon so far as the effects of its projectile upon those not immediately killed are concerned.

This is shown by the statistics, which demonstrate that many more wounded recover and more limbs are saved than when rifles of large caliber were used.

3. That in certain regions—head, face, and neck—it produces injuries of such grave character that modern surgical methods have not been able to reduce the mortality in wounds of these parts.

This is shown by the fact of the still high mortality of wounds in these regions, although treated according to the surgical principles which now obtain.

4. That in wounds of other regions; chest, abdomen and pelvis, the wounds as a class are less dangerous than with the old bullet, but in all these regions, the chest not excepted, are usually of grave import.

This is shown by the high mortality which still obtains in this class of wounds.

5. That in wounds of the extremities, the small-caliber bullet produces wounds which are rarely mortal, and which allow conservative treatment to an extent heretofore unknown. *It is in wounds of the extremities that the great reduction in mortality has occurred since the adoption of the new rifle and the use of aseptic and antiseptic methods.* This is proven by the tremendous reduction in mortality in wounds of these regions and the reduced number of major operative measures required.

Relative to Surgical Methods: 1. That asepsis and antisepsis have been as potent factors in reducing post-traumatic complications and mortality in military as in civil surgery.

This is proven by the reduced mortality arrived at by *recognizing* and *maintaining* the asepticity of bullet-wounds, and by treating infected wounds antiseptically, and, when necessary, by aseptic and antiseptic operative procedures.

2. That conservative treatment, made possible by aseptic and antiseptic methods, has been a most potent factor in the saving of life and limb.

This is proven by statistics of wounds of joints and compound fractures where the mortality from cases treated is almost infinitesimal.

3. That operative interferences on the field or at field hospitals should be restricted to operations imperatively demanded or to those cases where delay would be more dangerous than the septic infection liable to occur from operating under unfavorable conditions.

This is proved by the high mortality and the post-operative infection in cases operated on at the front—due to the practical impossibility of obtaining asepsis under the conditions which obtain at field hospitals.

Relative to Executive Departments: 1. That permanent base, and general hospitals equipped with all appliances for aseptic and antiseptic work should be established at points as accessible as possible to the field of operations and that facilities for transporting the wounded to these hospitals as quickly as possible should be provided.

By having hospitals so equipped and sending the wounded directly to them, lodged bullets can be located by the Roentgen-ray and removed with safety; operations for compound fractures where there is irreducible displacement of bone, or where the Roentgen-ray shows displacement liable to produce impairment of function, can be done and other necessary operative procedures can be safely undertaken with resulting conservation of function, limb, and life. This was the method adopted in our war with Spain and in the Anglo-Boer War; and, if carried out in

future wars, will greatly aid to reduce post-traumatic complications and the mortality of the wounded.

Finally, it is to be remarked that military surgery, viewed as a science, does not differ from surgery in general. It is governed by the same laws and founded on the same principles. Viewed as an art, it differs from ordinary surgical practice in that it deals with traumatisms seldom met with except in the field of war, and that being practised under peculiar and less favorable circumstances is less certain in its effect. Locality and environment frequently make a more heroic and decided form of treatment necessary, and equally, at other times demand that more conservatism be practised than in ordinary surgery. And lastly, military surgery demands of the military surgeon, not only that he should be well informed of the peculiar class of cases with which he has to deal and of the conditions under which they must be treated, but that he should be well grounded in the science of surgery in general, so that with comprehensive grasp and ever holding in view the ultimate welfare of his patient, he may bend his energies to that great end and apply his knowledge according to time, place, and circumstances with rightful prospect of success.

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XVIII. REMOTE EFFECTS OF GUNSHOT WOUNDS BY JACKETED PROJECTILES.

BY

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The remarks I am about to make have reference to the ulterior consequences and disabling effects of the armored, non-deformable projectiles. The Mauser bullet of 7 mm. and the brass jacketed bullet of 11 mm. are especially referred to because the cases to be included in this report were disabled by these projectiles in the recent Spanish-American war.

The ulterior effects of gunshot injuries from the older projectiles composed of lead, which were apt to deform, possessed lower velocities and a larger sectional area, are well known.

In dealing with remote effects of gunshot injuries we endeavor to demonstrate some of the ill effects which have remained after the healing of the wound has been accomplished. These disabling effects may be present shortly after the receipt of the injury as in a case necessitating amputation from extensive traumatism or they may be more or less remote, remaining stationary, or they may increase or diminish with months and years and again in some cases they may eventually lead to fatal consequences.

The so-called remote effects hitherto studied from the older projectiles involved:

1. Pain.
2. Secondary disease from lodged foreign bodies.

And then again these remote effects were studied from the particular anatomical structures of the body hit, as the blood vessels, the nerves, the bones, the tendons, etc., or they were studied from the disabling effects noted in certain bodily regions as the head, the face, the chest, abdomen and the extremities, etc.

Lodged foreign bodies have constituted the greatest source of protracted suffering in gunshot wounds. The foreign bodies included the missiles, or pieces of clothing or the accoutrement, or fragments of anything the soldier or civilian might be carrying at the time he was hit. Again, loose fragments of bone formed a large number among the foreign bodies in wounds.

Happily, lodged foreign bodies do not cut much figure nowadays in gunshot wounds from whatever weapon, because of:

1. The revelations of the X-ray.

2. The military rifles of the present do not so often tear bones asunder, leaving loose fragments; (*a*) their small-caliber bullets are less apt to carry pieces of clothing or other articles into the wound; (*b*) the projectiles are less apt to lodge; (*c*) when they do, and when for various reasons they are not extracted they are more apt to become permanently encysted because of their lighter weight and polished exterior.

Lastly, the clean surgery of to-day has made the surgeon bold to enquire into the interior of wounds. He is more apt to clear away menacing conditions at the time than to await their ulterior effects.

Case No. 1. Private S. R., Co. I, 10th Cavalry, received gunshot wound of the brain at battle of Guasimas, June 24, 1898. The projectile, a Mauser bullet, entered left parietal bone near coronal suture, it ranged backward and emerged through the same bone posteriorly at a point which cannot be definitely located. The history of the case is not at present ascertainable. I first saw the man at the base hospital when the surgeons were trephining his skull. I remember that sepsis had supervened, and that there was loss of brain substance. Remote effects.—Left cerebral hernia and right hemiplegia, including partial involvment of pharynx and larynx, causing difficulty in swallowing and partial loss of voice. Also right facial paralysis; later development of cerebral abscess and death, January 24, 1900. At autop·y large cerebral abscess involving left lateral and posterior lobes of brain. Hole in skull simply that left by trephining. No bullet found in brain.

Case No. 2. Private P. W., Co. G, 10th Infantry, wounded by a Mauser bullet at San Juan, Cuba, July 1, 1898, at a distance of about 400 yards. Projectile entered front and outer aspect of right knee, 2 cm. from upper and outer border of patella, and ranging downwards, backwards and inwards it lodged in the popliteal space whence it was removed July 5th at the Siboney hospital. The scar of entrance wound is oblong, 3 cm. in length, 1 cm. in width. The ball probably injured the external popliteal nerve, as it lies behind the head of the fibula. An attempt, made in a New York hospital, to remedy the paralysis by suturing the nerve ends, resulted in failure. Judging from the course of the ball the case was more than likely one of involvement of the synovial sac of the knee by fissuring into the joint. The man states that the knee was very much swollen at the time of the injury. There is atrophy of the leg and partial loss of flexion of the knee. A letter dated November 13, 1899, from Dr. Lucius W. Hotchkiss of New York, who operated for injury to the pop-

liteal nerve, states as follows: " * * * admitted to Bellevue Hospital * * * July 26, 1898. At that time there was a partially cicatrized wound at outer margin, right popliteal space, near biceps tendon. There was paralysis of motion and sensation over area supplied by external popliteal nerve and branches below seat of wound. * * * Operation revealed right external popliteal nerve involved in large amount of cicatricial tissue which apparently constricted it badly. The nerve itself seemed thickened. It was *not*, however, cut across, having probably been contused as to its fibers and left intact as to continuity of sheath. It was dissected free carefully and stretched, * * * discharged October, 1898, with partial restoration of sensation, but not return of motion." Remote effects.—Toe-drop, inability to flex the foot on the leg or to extend the toes.

Case No. 3. Private L. G., Co. E, 16th Infantry, wounded by a Mauser bullet at San Juan, Cuba, July 3, 1898, distance unknown. Projectile entered outer aspect of right knee joint between the outer condyle and head of tibia and ranging transversely across the head of the tibia it emerged at the inner side of the leg, 2 cm. below the head of the tibia. The limb was placed on a posterior splint; was sent to the base hospital at Siboney, July 10th. The entrance wound is marked by a round scar the size of the projectile; the exit wound a trifle larger. Remote effects.—Flexion of knee somewhat impaired. Rheumatoid pains in knee and tenderness over joint so that he is unable to kneel down without causing pain.

Case No. 4. Private C. F. M., Co. D, 6th Infantry, wounded by a Mauser bullet at San Juan, Cuba, July 1, 1898, at a distance of 300 yards. Ball entered right foot near ball of big toe, it ranged transversely across the foot through the metatarsal bone and emerged ou the outer side of the foot near the metatarso-phalangeal articulation of small toe. The entrance wound is marked by an elliptical scar about the size of the projectile; the scar at point of exit is larger, irregularly round. A radiograph by Dr. Borden shows splintering of the metatarsal bones. The fragments are displaced laterally following the flight of the ball. Remote effects.—Pain at site of wound and immobility of metatarsal bones due to bone fragments forming osseous bridge uniting the bones.

Case No. 5. Private C. F., Co. D, 6th Infantry, wounded by a Mauser bullet at San Juan, Cuba, July 1, 1898. Distance about 700 yards. Bullet entered outer aspect of right thigh, 3 cm. below Poupart's ligament, opposite a point corresponding to the location of the anterior crural nerve, branches of which were probably severed, ranging directly backward it emerged in the

buttock of the same side. The scar marking the wound of entrance is slightly oblong, about the diameter of projectile. The wound of exit is marked by a linear scar 1 cm. in length. On the outer and posterior aspect of the upper thigh there are four small scars which mark the location of splinters of bone, which were removed by the surgeons. The patient states that the fragments were very small. If we have reason to adhere to the rule that the hip joint may be included in a triangle, the angles of which are at the spine of the pubes, the anterior inferior spine of the ilium and the outermost part of the trochanter, it may be assumed that this case represents a gunshot perforation without fracture of the surgical neck of the femur, and that the fragments were spiculæ of bones chipped from it which acted as secondary projectiles. Remote effects.—Slight limitation of movements at hip joint. Moderate atrophy, stiffness and impaired nutrition of leg. Fig. 2.

Case No. 6. Private R. N. J., Co. F, 3d Wisconsin Volunteers, wounded by a Mauser bullet at Abonita Pass, Porto Rico, August 12, 1898. He was hit by a ricochet bullet which struck the middle of the anterior surface of the tibia at a tangent, making a vertical wound of entrance about 3 cm. in length. There was splintering of the tibia at point of impact without fracture. The lead nucleus of the projectile and some splinters of bone were removed four days after the injury. Two months later part of the steel jacket of the bullet was located by the X-ray and removed. Two abscesses near the wound were evacuated about this time. Remote effects.—The scar is painful; there is weakness of the ankle.

Case No. 7. Private H. R. O'M., Co. L, 8th Infantry, wounded by a Mauser bullet at El Caney, Cuba, July 1, 1898, 600 yards from the Spanish fire. The wounds were received whilst he was holding his gun in the act of firing. The projectile inflicted a lacerated wound on the radial side of the middle finger of the right hand, ranging backwards, it entered the end of the right thumb on the palmar aspect, coursing along the phalanges and metacarpal bone of the thumb it emerged opposite the middle of the latter; it next glanced on the inner aspect of the corresponding arm, cutting the skin over the middle of the biceps. The wound of entrance in the thumb is marked by a faint vertical linear scar 1 cm. in length, the wound of exit opposite the middle of the metacarpal bone is irregularly round, 1 cm. in diameter. Remote effects.—Loss of flexion of the thumb, middle and index fingers.

Case No. 8. Private I. T., Co. F, 10th Cavalry, wounded by a Mauser bullet (?) at San Juan, Cuba, July 1, 1898, while

facing the Spanish fire 500 yards off. The projectile entered the point of the right elbow, passing through the olecranon, it ranged forward and emerged 6 cm. below the bend of the elbow. The wound of entrance cannot be judged by the scar as it was enlarged by the knife. The wound of exit is marked by a scar irregularly round, 2 cm. in its greatest diameter. The projectile caused a complete perforation of the ulna. The man states that the ball entered the front part of the arm and emerged posteriorly. This is doubtful from the character of the lesion in the olecranon the remains of which show a round depression such as might have been left after a perforation by a small caliber bullet. The scar in the forearm is more like that of a wound of exit. If he was wounded from behind, as is likely, the injury was very probably inflicted by a Krag-Jorgenson rifle from our own men. Remote effects.—Partial loss of flexion, pronation fair, supination much impaired.

Case No. 9. Private D. B. W., Co. G, 1st Cavalry, wounded at Guasimas, Cuba, by a Mauser bullet, June 24, 1898. The projectile entered dorsal aspect middle right forearm and ranged upwards and inwards, emerging near the bend of the elbow, it re-entered the body in the right abdominal wall at a point halfway between the anterior superior spine of the ilium and umbilicus. The ball remains lodged, presumably. The wound of entrance in the forearm is marked by a faint round scar corresponding in diameter to that of the projectile; the wound of exit near the bend of the elbow is marked by an irregular scar 3x2 cm. The wound in the abdominal wall is marked by an elliptical scar 2½ cm. in its greater diameter. Radiograph shows a spur of bone on the outer side of the middle of the radius due to union of displaced bone fragments. Remote effects.—Loss of supination of forearm. Fig. 3.

Case No. 10. Private L. G., Co. A, 22d Infantry, July 1, 1898, at El Caney, Cuba. Mauser projectile entered outer aspect of left thigh in front of great trochanter, ranging downward, backward, and inward, perforating the trochanter, cut sciatic nerve and emerged in left buttock, about 2 cm. above gluteofemoral fold. Distance 350 yards. Wound of entrance is round and a trifle larger than projectile. Wound of exit the same and marked by a slit. Scars of both wounds protuberant. The case is one that might be benefited by nerve suture. Remote effects.—Loss of flexion and extension of foot, and hyperesthesia of the skin of leg and back of thigh from probable neuritis.

Case No. 11. Private J. E., Co. M, 3d Cavalry, accidentally wounded at Augusta, Georgia, May 25, 1899, by a Krag-Jorgenson bullet. Distance 12 feet. Ball passed through right leg just


Wound of entrance
Fig. 1
Fig 4.
Fig. 5.
Fig 2

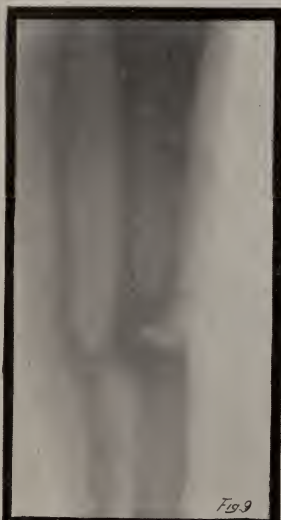
Fig. 9


Fig. 7


Fig. 6


Fig. 8

above the ankle. Wound of entrance oval, about 2 cm. in diameter. Wound of exit irregularly oval, about 4x2 cm., situated transversely just above the external surface of ankle joint. Fleshey band supported by a thin fragment of bone left anteriorly, a band of flesh only, left posteriorly. Bones in course of bullet blown out of wound of exit as quill-sized spiculæ and ranging from that size down to bone-sand. Bone above greatly fissured. Fragments of bone afterward dug out of ground by comrades. Condition of foot was such that it was amputated next day. Healed in one week with a large pocket of fluid in stump. Second operation one week later, fluid removed, flesh trimmed, wound closed with drainage. Healing completed in one month. Immediate and remote effects.—Amputation. Result.—Painful stump.

Case No. 12. Private J. D., Co. B, 18th Infantry, admitted to Soldiers' Home, November 2, 1899; wounded by a Remington bullet, caliber .45, at a distance of 1,000 yards, at Jaro river, Panay, P. I. The bullet entered outer aspect right knee, penetrating the external condyle of the femur, 2 cm. above the articulation, ranging downwards, slightly inwards and backwards, it emerged from the calf of the leg 6 cm. below the bend of the knee. Scar marking wound of entrance circular, 1 cm. in diameter. Scar at wound of exit is elliptical, 2x3 cm. There are three small scars between the bend of the knee and scar showing wound of exit due to spiculæ of bone, or pieces of the bullet acting as secondary missiles. Aside from the injury to the bone, the external popliteal nerve was cut. There is a vertical linear scar 11 cm. in length which marks an attempt to suture the nerve one week after the injury. Remote effects.—There is partial loss of extension, but good flexion of the knee. There is paralysis of the muscles supplied by the external popliteal nerve, giving rise to toe-drop, which causes considerable interference with walking. There is also considerable weakness of the lower leg, being unable to go about without crutches.

Case No. 13. Private J. S., Co. D, 7th Infantry, wounded by a Mauser bullet at El Caney, Cuba, July 1, 1899. He was hit by a ricochet bullet which struck the anterior surface of thigh at junction of upper and middle thirds, passed through the thigh and lodged beneath the skin about 6 cm. above bend of knee posteriorly. Bullet was removed at Siboney Hospital on July 4, 1898. Wound of entrance long, oval, 2x1 cm., shape that of longitudinal section of a bullet. Wound of operation small, linear. Wound of entrance was infected and required six weeks to heal. Two weeks after injury he first noticed pain in limb along the course of the external popliteal nerve, which increased for two

weeks, but since then has been diminishing and is now almost absent. Remote effects.—There is some weakness in all of the muscles of the lower leg. No anesthesia of skin. Slight tenderness over outer and middle thirds of thigh over the course of the bullet.

Case No. 14. Private L. K., Co. H, 22d Infantry, wounded July 1, 1898, at battle of El Caney, Cuba, by a Mauser bullet in upper thigh. Ball entered left groin 1 cm. below and 2 cm. inside of anterior superior spine, lodged beneath the skin at anterior margin of great trochanter. Wound of entrance is linear, about 6 cm. long, extending from outer border of rectus muscle to just inside of anterior superior spine. June 5th bullet removed by operation at the middle hospital. Bullet was slightly flattened and deformed at the end. Wound of entrance was infected. Healing not complete until October, 1898. Remote effects.—Slight weakness of left leg noticed after exertion and occasionally has needle-like pains at seat of wound.

Case No. 15. Private L. K., Co. 3, 13th Infantry, wounded at San Juan, Cuba, July 2, 1898, by a Mauser bullet. Distance estimated at 800 yards. Bullet entered left temple 2½ cm. posterior and 1 cm. above external canthus of eye, coursed down, in, and back and emerged 3 cm. below right mastoid process on level with angle of jaw. Wound of entrance scarcely visible. Wound of exit linear, ¾ cm. long. Remote effects.—Loss of sensation over left half of face. Slight impairment of hearing, paralysis of left internal pterygoid muscle. Some stiffness of muscles of neck. Keratitis developed left eye early in the history of the case. The inflammatory process has continued ever since. There is now almost total blindness from corneal opacity.

Case No. 16. Private J. S., Co. G, 4th Infantry, wounded at San Juan, Cuba, July 1, 1898. He was lying down on top of the hill with his head to the enemy, when a bullet passed through his foot. Upper wound is on dorsum of foot over first metatarsal bone. Lower wound is on plantar surface corresponding, is linear, about 2 cm. long. Operated on hospital ship "Relief," July 24th, and several pieces of bone removed through upper wound. Healed completely and he re-enlisted December 23, 1898. Sent to Philippine Islands where wound broke down and suppurated. Radiograph shows perforation of the metatarsal bone of great toe with some enlargement. Remote effects.—Slight rheumatoid pains off and on in foot. Stiffness and partial loss of power in toes. Fig. 4.

Case No. 17. Private W. K., Co. H, 24th Infantry, while on duty at Presidio, Cal., June 25, 1899, was accidentally shot by a comrade. Distance about 20 feet. Bullet was a Krag-

Jorgenson. Entered left tibia 4 cm. below patella and emerged from most prominent portion of calf, 10 cm. below bend of knee. Wound of entrance transverse, oval 1x$\frac{3}{4}$ cm. Wound of exit oval, puckered, retracted 2x1 cm. Upper third of tibia extensively commimuted, small fragments of bone being freely movable under the surface of the skin. The fracture undoubtedly extended into the knee joint as a large amount of synovial fluid escaped from wound of entrance. The muscles of the calf appeared to be separated, an apparent cavity existing immediately back of wound of exit. Treatment.—Dressing and immobilization. Wounds healed in three weeks. Able to walk in eight weeks with aid of cane. Left ankle and foot remained weak and sole of foot felt numb, with occasional needle-like pains shooting through it. Ten weeks after injury it was thought that he would eventually recover entire use of leg. Remote effects.—Eight months after injury are weakness of all muscles of posterior aspect of leg also of extensor hallucis, and loss of sensation over anterior 2-3 of plantar surface of foot. Some stiffness of foot and ankle still present and he is unable to walk without aid of a cane.

Case No. 18. Private T. S. H., Co. I, 10th Cavalry, received a gunshot wound of arm and chest at battle of San Juan Hill, Cuba, July 1, 1898. He was lying down facing the enemy with left arm thrown forward to support his rifle. The projectile, a Mauser bullet, entered posterior and outer aspect of arm 5 cm. above tip of external condyle of humerus, passed upwards and a little posterior to emerge at the posterior aspect of arm near its center at a point 20 cm. above the olecranon. The bullet then entered chest wall at a point between the fifth and sixth ribs when arm is extended, and lodged in body. Wounds on the arm are very similar, both being circular and about $\frac{1}{2}$ cm. in diameter, but the wound of exit is a trifle the larger. The wound on the chest is protruding, irregular circular, about 1 cm. in diameter, and varies from 5th to 6th ribs, according to position of arm. Radiograph shows the bullet resting upon the head of the femur, the rear end of the bullet below. Remote effects.—At times he has been troubled with dull pains, soreness and stiffness down left side from wound in chest to left hip. Fig. 5.

Case No. 19. Private J. J. W., Co. D, 9th Infantry was wounded in battle of San Fernandez, P. I., August 9, 1899. The bullet was a Remington, passed through right forearm. Distance 200 to 300 yards. Wound of entrance is oval 1x1$\frac{1}{4}$ cm. and 6 cm. below bend of elbow. Wound of exit is on dorsal and inner surface of forearm over the ulna 10 cm. below the tip of olecranon Healing was complete in about six weeks. Treatment.—Antiseptic

dressings. Radiograph taken May 2, 1900, shows no injury to either radius or ulna. Remote effects.—Marked weakness of hand and wrist, especially of fingers, the hand tending to take on the characteristics of the claw hand, swelling of hand and forearm if allowed to hang at side for a short time; pain and soreness frequently present in forearm.

Case No. 20. Private F. F., Co. G, 14th Infantry, was wounded October 8, 1899, in an engagement near Cavite Viejo, P. I. Distance from firing line of enemy from 100 to 125 yards. Bullet, which was supposed to be a Mauser, entered left forearm over posterior radial border at junction of middle and upper thirds. From there the bullet passed up and in, emerging at upper extremity of forearm on ulnar border, about 1 cm. below internal condyle. Wound of entrance circular 1 cm. in diameter. Wound of exit irregular oval, 2½x1 cm. Both bones supposed to have been broken by bullet in its course and immediate loss of power in first and second fingers also resulted. Wounds were packed with gauze for twenty-four hours and then a drainage tube was passed through arm which remained there several days. Wounds not healed for over a month, and arm not useful until January, 1900. Radiograph taken May 1, 1900, shows that the bullet passed through the radius, fracturing the bone and driving small pieces of bone in direction of its course and at right angles to it. Remote effects.—Loss of pronation and supination of forearm due to bone injury, partial paralysis of muscles of forearm more or less marked on the extensor side; impaired nutrition of hands. No loss of sensation. Fig. 6.

Case No. 21. Private J. McH., Co. L, 4th Infantry, wounded at battle of Dasmarinas, P. I., June 19, 1899. The firing line of enemy was from 100 to 200 yards distance. Bullet was a Mauser. It entered left foot on inner side near center of first metatarsal bone. It passed transversely across foot, passing through first metatarsal, grooving second metatarsal and emerging from dorsum of foot over third metatarsal bone. Wound of entrance is represented by a very small circular scar about ¼ cm. in diameter. Wound of exit by an oval scar about 1x¼ cm. Healing was complete in about one month. No operation. No pieces of bone removed at any dressing. Radiograph taken May 8, 1900, shows an osseous bridge between first and second metatarsal bones in track of bullet. Remote effects.—Pain and soreness at times in wound, weakness of flexors of toes with resulting weakness of the foot. Slight limping in fast walking.

Case No. 22. Private E. K., Co. D, 21st Infantry, was wounded at battle of San Cristobal, P. I., October 23, 1899. He was struck in the left knee by a Remington bullet, ricochet, at a

distance of 250 yards. Wound of entrance is an oval scar, $1\frac{1}{2}$x1 cm. situated vertically over outer aspect of knee joint, 1 cm. from left margin of patella and 1 cm. above the depression corresponding to the articular surface entering the knee joint. He was kneeling when shot and ball was lodged. Knee joint became red, swollen and painful and continued for two months during which time the wound was suppurating, after two months wound was healed. Radiograph taken May 15, 1900, shows bullet lodged in tibia 1 inch below knee joint, with its tip pointing towards wound of entrance, showing that projectile entered base end to. Remote effects.—Chronic arthritis of left knee joint with weakness and swelling of entire leg, there being only 20 deg. of motion possible and extension lacking 15 deg. of straightening leg on thigh. Pain at present only on walking, then generally sharp at first, but later becomes constant and aching. Painful area is just below knee joint and inside of head of fibula. Fig. 7.

Case No. 23. Private J. F., Co. E, 6th Infantry, wounded in battle of San Juan, Cuba, July 1, 1898, estimated distance about 600 yards. Bullet, which was a Mauser, passed through left forearm near elbow and entered left side of chest in middle axillary line over eleventh rib, where it is lodged, position unknown. Wound of entrance in forearm is circular, 1 cm. in diameter, on posterior aspect just outside of ulna and 6 cm. below elbow joint. Bullet passed up and in, breaking radius in its course and emerged on inner aspect of upper arm just above middle point of arm. Wound of exit, transverse oval, $1\frac{1}{2}$x$\frac{3}{4}$ cm. For four days after injury he was unable to move either leg. Then slowly recovered power of legs and after three months complete power of legs was restored. Healing of wounds was not completed for four months, there being a constant discharge of pus for that time. Radiograph shows that the radius was extensively fractured by the bullet in its passage through the arm. Remote effects.—Impaired sensation in hand; complete loss of power of all muscles of forearm, with subsequent wrist-drop; chronic arthritis of elbow joint, arm could not be extended beyond a right angle, motion being possible over an angle of about 30 deg.; constant pain in elbow. Wound in side occasionally gives a little trouble, mainly a slight soreness or stitch in side after exertion. April 20, 1900, amputation of arm, just above elbow performed on account of constant pain in elbow and complete paralysis of forearm and hand. The radius was found to have been broken about 3 cm. below the bicipital tubercle and an osseous bridge extended over to the ulna binding the two bones firmly together.

Case No. 24. Private S. K. H., Co. D, 4th Infantry, wounded

in battle of Dasmarinas, P. I., June 19, 1899. The distance to the firing line of the enemy was about 300 yards, but the man feels positive that he was hit by a sharpshooter in a tree, at a distance of 100 feet. Bullet which was supposed to be a Mauser passed through chest. Wound of entrance is circular, in fourth intercostal space, at right margin of sternum. Wound of exit is on same level, 6 cm. from spine. Was in hospital for one month, with high fever and delirium. Hemoptysis for one week after injury. Empyema developed on right side, which was opened July 17, 1899. Since then improvement has been slow, but steady. Remote effects.—Slight flattening and some weakness of right side, some pain in right side on exertion. No symptoms of tuberculosis manifested up to date.

Case No. 25. Private P. W., Co. B, 4th Infantry, wounded at battle of Dasmarinas, P. I., June 19, 1899, by a Mauser bullet at a distance of 250 to 300 yards. The ball passed through the lower jaw, breaking the inferior maxillary bone at two places; on the left at the angle of the jaw, on the right just anterior to the angle. Wound of entrance represented by a small circular scar ½ cm. in diameter; wound of exit by a scar 1x½ cm. There was purulent discharge from wound of exit for five months and healing not completed until December, 1899. The three last molars on the right side were knocked out by the bullet in its transit. Remote effects.—Inability to separate teeth more than ½ cm. Slight discharge still from right side of jaw, where teeth were driven out. No interference with control of tongue, taste or sensation over chin.

Case No. 26. Sergeant J. B., Co. L, 3d Artillery, wounded March 25, 1899, by a Remington bullet in battle of Caloocan, P. I., at a distance of 400 yards. Was struck by ricochet shot. Bullet entered middle of right leg directly over center of tibia; passed through the leg, emerging on its inner surface and lodged beneath legging. Wound of entrance was round, about 2 cm. in diameter, wound of exit about 2x1 cm. Both wounds suppurated. The tibia was extensively fractured by bullet in its course. On June 17, 1899, pieces of bone removed at First Reserve Hospital, Manila, P. I. Again, December, 1899, at Presidio, Cal., several small pieces of bone removed by operation. Radiograph taken May 7, 1900, shows that both bones were broken and they are now joined by an osseous bridge. Remote effects.—Toe-drop, the heel being raised 2 cm., considerable weakness and stiffness of leg. Also pain at site of wound, when he attempts to bear weight upon foot. Compelled to use crutches. Fig. 9.

I hand you a number of radiographs exhibiting the lesions connected with remote effects.

The absence of remote effects as noted in foregoing cases, except such as relate to the anatomical structures involved, adds in no small degree to the already acknowledged humane features of the jacketed bullet.

XIX. THE DIAGNOSIS AND TREATMENT OF GUN-SHOT WOUNDS OF THE ABDOMEN. REPORT OF THREE CASES.

BY

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The subject of gunshot wounds of the abdomen is interesting both to the civil and the military surgeon, because at all times he may be called to treat them, and in times of war the military surgeon is likely to have a large experience in such cases. It is especially interesting because it is the field in which the exercise of good judgment and skill is so frequently followed by brilliant results.

Most cases of gunshot wounds of the cranial cavity are fatal in spite of the best treatment, so that here the surgeon can only occasionally expect a good result; those of the chest frequently recover without special treatment of any kind, and owing to the bony chest wall and the complications incident to opening the pleura, pericardium, or cutting into the lung, these wounds are not very amenable to surgical treatment; while the abdomen being so accessible and with comparatively so few complications, presents the most favorable field of any of the great cavities of the body for the treatment of wounds of its viscera.

As is well known, these injuries are more fatal in military than in civil practice, principally for the reason that in the former case the conditions suitable for operation cannot be obtained until the patient has been weakened by hemorrhage or the onset of peritonitis. The golden time for operation is the earliest possible moment after the receipt of the wound. If there is considerable shock, reaction should be first established unless the shock is due to hemorrhage, in which case there should be no delay, as the condition will grow worse as long as the hemorrhage continues. The first point to determine is whether or not the abdominal cavity is penetrated. The direction of the ball is important in giving a probability of the viscera being wounded. For example, the course most likely to wound viscera is one in which the ball passes low down and from side to side through the abdomen. An antero-posterior course high up is least likely to wound viscera.

Shock is a very uncertain symptom; in most cases it is present in greater or less degree, in others it is absent, although serious injuries may exist. In case No. 2 there was no shock, although there were ten perforations of the intestine and twelve of the mesentery.

The Pulse is rapid and weak if there is much shock or hemorrhage. The same is true after peritonitis begins. As with shock, cases often occur in which the pulse is no index to the true condition.

The Temperature is often depressed if shock exists, but it afterward rises and continues more or less elevated if peritonitis result.

Vomiting is a common symptom; it may be present early or not until peritonitis sets in.

Pain is usually present, and nearly always there is tenderness to pressure.

Restlessness and Thirst are common, especially in cases of hemorrhage.

The Differential Diagnosis from wounds of the abdominal wall which have not penetrated the cavity is frequently impossible without probing or exploratory incision, for during the first hour or two after a fatal, penetrating wound the symptoms may indicate nothing more than a slight injury.

Given a case in which a straight line connecting the wound of entrance and exit passes through the normal position of the liver, stomach or intestines, with symptoms of shock, a rapid thready pulse and vomiting, there is probably perforation of an important viscus. If in addition the patient is restless and thirsty with a tendency to syncope, serious hemorrhage is going on.

In civil as in military surgery the first aid rendered the patient may decide his fate. This should consist simply in the application of sterile or clean dressings to the wounds without the slightest attempt at exploration, as the introduction of a finger or instrument which has not been disinfected, may infect the wound and turn the scale against the life of the patient.

There are three ways by which the peritoneal cavity may become infected, leaving out the possibility of infection by the surgeon:

1. By the escape of the contents of the intestines or stomach.

2. By organisms carried in by the ball in the shape of scraps of clothing or the germs on the ball itself.

3. By wounding and bruising the tissues, thus producing a *locus minoris resistentiæ* for the location of microbes floating

in the blood or enabling those in the intestines to migrate out into the peritoneal cavity.

As soon as possible the patient should be taken to a hospital or to his home and all preparations made for a thorough exploration of the wound and, if necessary, celiotomy and the treatment of any condition which experience has shown may exist in such a case.

Preparations having been made for doing all that may be required, the next step is to anesthetize the patient and introduce the finger or probe into the wound in order to see if it penetrate the cavity. It is often impossible to induce a probe to follow the pathway of the ball, owing to the openings through the different structures not being exactly in line from more or less contraction or relaxation of muscles or layers of fascia. In this case the probe should be gently introduced as far as it will go and the tissues divided with the knife and retracted to the depth of the probe, when the probe may possibly be inserted to a sufficient depth to show that the cavity has or has not been penetrated; or it may enter only a short distance further, whereupon the process of dividing the tissues in the line of the probe should be repeated until the route of the ball is made clear.

Should the ball have entered the peritoneal cavity, the incision should be enlarged sufficiently to examine the viscera immediately beneath. The intestines may be withdrawn loop by loop and replaced by an assistant as rapidly as withdrawn until almost the entire length of the small intestine has been inspected. Usually the wounded portion will be found very near the opening in the abdominal wall. Other organs, as the colon, stomach, spleen, liver, etc., may be determined partly by inspection, partly by palpation with the hand in the abdominal cavity.

Wounds in the posterior wall of the stomach, inaccessible from the front may be reached by an icision in the anterior wall of that organ. Should there be considerable hemorrhage, the surgeon should first endeavor to find its source and arrest it by ligatures or by compression. Sometimes it may be necessary to compress the aorta by the fingers below the diaphragm until the field can be sufficiently cleared to find the bleeding points.

Wounds in the intestine or stomach may be closed by a round curved needle with two rows of fine silk sutures; the first passing through all the coats, and the second omitting the mucous membrane and approximating the serous coat. It is unnecessary to trim the margins of the wounds except to make them smooth when very ragged or to cut off the protruding mucous membrane, which prevents approximation.

Wounds of the liver, kidney or spleen may be closed by

carefully inserted and gently tied sutures which should include a large amount of tissue to prevent cutting through, or they may be packed with gauze for forty-eight hours.

Irrigation with salt solution is not necessary unless there has been extravasation of intestinal contents or excessive hemorrhage. It is probably best as a rule only to sponge out the cavity, carrying the sponges into the pelvis.

If the toilet of the abdomen is complete and no gauze compresses have to be left inside, it is best to close the abdomen without drainage. The method of closing the wound should depend on the situation of the incision and its nature. When the incision is longitudinal through the fibres of the rectus muscle, a through-and-through set of interrupted sutures of silkworm gut may be first introduced, and the edges of the peritoneum, including the sheath of the rectus then brought together with a continuous catgut suture, finally tying the silkworm gut sutures. If the incision is in the lateral abdominal region dividing muscular fibres transversely, besides inserting through-and-through sutures, the severed ends of each muscle should carefully be brought together with catgut sutures, before tying those first inserted.

Although recommended by so high an authority as Senn, I never used hydrogen gas as a diagnostic test of perforation of intestine because it seems to me not only uncertain and misleading, but likely to infect a previously uninfected peritoneal cavity by forcing intestinal contents through the openings. The same objection applies to air and water. As previously stated, diagnosis is often impossible without operation. I recall the case of a man shot in the thigh who, in less than twenty-four hours, developed symptoms of peritonitis with vomiting, elevation of temperature and rapid pulse. The patient died without operation and the necropsy showed general peritonitis from perforation of the upper part of the rectum—the ball having passed up the thigh, into the pelvis, through the rectum and into the abdominal cavity.

It may be stated then (1) that the most important point is to determine whether or not the viscera have been wounded; (2) that in many cases this fact cannot be determined in time to be utilized to the patient's greatest advantage without celiotomy; and, (3) that the proper procedure in all doubtful cases is to make an exploratory celiotomy during the first hour or as early as possible, because in a given number of cases there can be no doubt that many more lives will be saved by this than by any other method of treatment.

CASE I.—*Liver, Colon and Kidney Wounded—Burn by Roentgen Ray—Recovery.*—S. D., colored, male, aged 18, was shot in the right side about noon, March 5, 1898. The ball from

a 32-caliber pistol entered between the eighth and ninth ribs on the right side in front of the anterior axillary line. The probe failed to follow the track of the ball and from the lack of serious symptoms it was thought that the ball might have glanced on a rib and not penetrated the abdomen. The Roentgen ray showed the ball near, and to the right of, the spinal column. That night the patient vomited twice and a little blood was observed in the urine; next morning his pulse was 90 and temperature 38 deg. C. For sufficient reasons the operation could not be done until 4 P. M., March 6, twenty-eight hours after the receipt of the wound, when, under ether, the abdomen was opened in the right linea semilunaris and this incision afterward supplemented by a transverse incision just below the margin of the ribs. The track of the ball was through the diaphragm, right lobe of the liver, hepatic flexure of the colon, and lower part of the right kidney, beyond which it could not be traced. The openings in the colon and kidney were closed with fine silk—the wound in the kidney was still bleeding while the wound in liver was dry and so was not molested. There was considerable bloody serum in the peritoneal cavity and this was washed out with warm salt solution and the wound closed without drainage. Primary union followed without suppuration in the wounds, but two Roentgen ray burns resulted; a small one on the back and a large one in front, 20 by 10 centimeters in extent, which caused sloughing of the skin and fascia down to the muscles and took a little over one year to heal. This burn seemed in no way to hinder the union of the wounds through the muscles.

CASE 2.—*Ten Perforations of the Intestines and Twelve of the Mesentery—Recovery.*—G. A. F., aged 31, white, male, was shot about ten P. M., May 26, 1898. When seen about forty-five minutes after receiving the wound, his pulse was 84; temperature was not taken; some pain and tenderness over the abdomen; no nausea, vomiting, nor evidence of shock and his symptoms did not indicate anything serious. A hole made by a ball from a pistol of 41 calibre was seen in the left side of the abdomen about 2½ centimeters above the middle of a line drawn from the navel to the anterior superior spine of the ilium and a little nearer the navel. Preparations were made for exploration and celiotomy, and chloroform was administered. The probe could not be passed along the track of the ball except for a short distance, so an incision was made down to this point; the probe was then passed deeper and another incision made, and so on till the opening in the peritoneum was reached. Blood flowed freely from the peritoneal cavity. The wound was enlarged and the first coil of intestine presenting was found wounded. Eight per-

forations were found in the lower part of the jejunum and two in the ileum, while twelve holes were found in the mesentery, making twenty-two openings, twenty of which required closing. This was done by two rows of silk for the intestinal perforations and one for those in the mesentery, suturing the two layers of the mesentery separately. The ball was found unscarred, wrapped in the great omentum. There were at least 250 c. c. of blood in the abdominal cavity, but no intestinal contents were visible. The cavity was freely flushed out with salt solution and the wound closed without drainage. The operation lasted two and a half hours and the pulse was 124 at its termination. Next morning the patient was purged freely with magnesium sulphate. On the third day the pulse and temperature were normal and there was uninterrupted convalescenc. The stitches were removed on the fifteenth day.

This case shows the impossibility, without operation, of making an accurate diagnosis in the first hour or two after the receipt of an injury which without treatment would have been fatal. It also shows the good results of operating early before the onset of peritonitis. This case was first reported in the *Medical News* of July 23, 1898.

CASE 3.—*Two Perforations of the Stomach and Five of the Intestine—Death.*—J. L., colored, male, aged about 35, was shot about 3 o'clock P. M., December 12, 1899. The ball from a pistol of about 41 caliber entered the back about 6 centimeters from the median line just below the last rib, and could be felt beneath the skin in front about 5 centimeters from the median line and 2½ centimeters below the navel. The patient walked into the hospital, and about 2½ hours after receiving the wound his condition was as follows: Pulse, 120; extremities cold; several attempts made to vomit; no desire to urinate. A urethral stricture and a perineal fistula existed, so that attempts to pass a catheter failed. There was great thirst with restlessness. Under ether the abdomen was opened through the left rectus muscle with the ball in the line of the incision. This was later joined by a transverse incision to the left below the ribs. On opening the peritoneum, blood and clots gushed out, amounting probably to 750 c. c. Five openings in the small intestine were closed and two in the stomach near the pylorus and greater curvature, besides two wounds of the intestine which did not perforate the walls. The hemorrhage was chiefly from the stomach. No intestinal contents were seen, but the peritoneal cavity was flushed with salt solution and the wounds closed without drainage. During the operation, which required about two hours, the pulse arose to 140 or 150, but was 130 at its termination and

the patient seemed in fair condition when put to bed. However, he died suddenly about one hour later. The necropsy showed that there was very little blood in the abdominal cavity and all the wounds had been closed. The right ureter was dilated sufficiently to admit the thumb and the kidney was cystic.

This case shows the bad results of delay. There was no difficulty in making a diagnosis of the hemorrhage, and the patient's death was principally due to that, possibly aided by the diease of the kidney.

XX. THE MORTALITY OF WAR WOUNDS, WITH SOME TENTATIVE CONCLUSIONS RELATIVE TO THE EFFECT OF THE MODERN RIFLE.

BY

CAPTAIN W. C. BORDEN,

ASSISTANT SURGEON, U. S. A.

Deaths from war wounds occur either immediately, as the direct result of the traumatisms inflicted, or remotely, as the result of the traumatisms plus certain morbid changes. In discussing the mortality from war wounds, it is necessary, therefore, to consider the immediate and remote mortality separately.

The immediate mortality, namely, those deaths which occur on the battlefield, is due entirely to the destructive action of war weapons, the fatal result being entirely due to the character of the traumatisms inflicted. It follows that the number of deaths in every one hundred persons injured by weapons of war, will vary according to the more or less destructive effect of the weapons employed.

The weapons now used in war are divided into two main classes; hand weapons and fire-arms. The hand weapons mostly used are the saber, bayonet, and lance. The fire-arms are rifle and revolver, and, to this class producing gunshot wounds, are to be added machine guns and cannon. Of these, the rifle produces by far the largest percentage of wounds, fully 90 per cent. of all battle wounds being inflicted by this weapon.

TABLE I.—PERCENTAGE OF WOUNDS BY DIFFERENT ARMS.

Wars.	Small Arms (per cent).	Artillery (per cent).	Side Arms (per cent).
American Civil (Otis)	90.1	9.8	0.37
Franco-German (Fischer)	94.0	4.7	1.3
China-Japan, 3d Division, 2d Army Corps (Haga)	90.8	7.6	1.5
Spanish-American, U. S. Regulars (Official)	92.2	7.8	0.0

The wounds made by rifle and cannon shot are also by far the most fatal, and, with the increased range of these weapons and the consequent wider separation of the combatants, the per-

centage of wounds produced by these arms closely approaches the total of all wounds made in war. Thus in the American Civil War, in about 10,000 wounds of the head there were but 300 made by saber and bayonet, and in about 19,000 wounds of the chest only 38 were made by hand weapons. From this it may be seen in computing statistics of wounds, those made by saber and bayonet are so few in number that they may be practically ignored, and the figures obtained may be considered as practically showing the mortality arising from gunshot. Further, it may be stated that as the wounds made by cannon shot have not materially changed in character, the statistics of war wounds should vary, if they vary at all, in accordance with the destructive action of the rifle used. In general terms it follows that, if the immediate mortality arising from war wounds varies to any extent in different wars, the variation would be most largely influenced by the rifle with which the troops are armed.

TABLE II.—KILLED, WOUNDED, AND WOUNDED WHO DIED AFTER COMING UNDER TREATMENT, IN RECENT WARS.

Wars.	Killed.	Wounded.	Died of Wounds.
Crimean, 1854–56, English	2,755	12,094	1,840
Crimean, 1854–56, French	8,250	39,968	4,359
France-Austria, 1859–60, French (Chenu)	2,356	17,054	2,962
American Civil War, 1861–65, Federals (Otis)	44,238	246,712	31,978
Prussia-Denmark, 1864, Prussians (Loeffler)	422	22,021	316
Austria-Prussia, 1866, Prussians (Loeffler)	2,553	12,094	1,455
France-Germany, 1870–71, Germans (Official)	17,255	99,566	11,023
Russia-Turkey, 1877–78, Russians (Official)*	11,905	43,386	4,955
China-Japan, 1894–95, Japanese 3d Division (Hagal)	210	1,105	108
Spanish-American, 1898, Americans (Official)	266	1,594	106
Philipino (Official)	233	1,367	96
Anglo-Boer, 1900, up to April 8†	2,171	10,510	513

* The official reports give the number of killed in the Army of the Danube, but not in the Army of the Caucasus.

† These figures are from the London Lancet, 1900, and are quoted from official reports so far given out.

With the adoption of the modern small-calibre rifle, firing mantled projectiles with high velocity, many experiments were

made, and much speculation was indulged in as to the immediate death-dealing properties of the new missile. It remained for actual war trial to demonstrate what the immediate death-dealing power of the modern bullet really is. We now have statistics of the Spanish-American War, the war in the Philippines, and the Anglo-Boer War up to April 8, 1900, with which to compare the statistics of former wars.

The figures given in table 2, when represented on a chart, show graphically the curve of total mortality, the immediate mortality and the remote mortality in recent wars. (Chart I.)

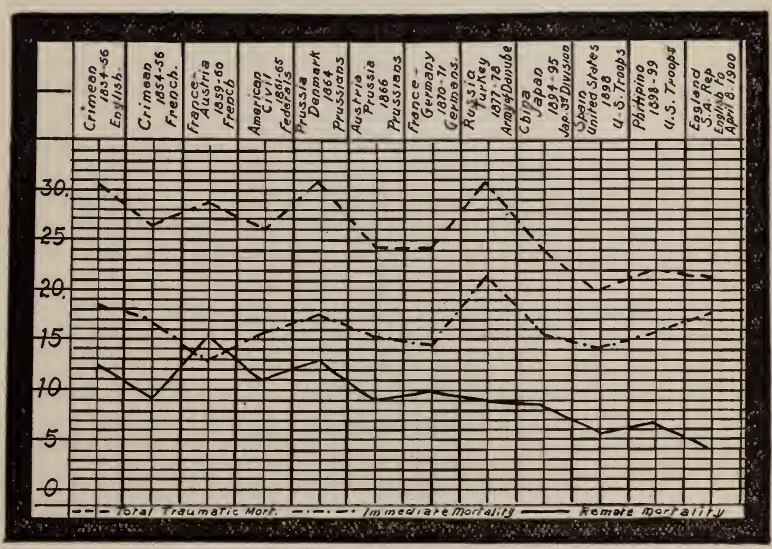

CHART I.—Showing curve of immediate, remote, and total mortality in recent wars.

In this chart the line of immediate mortality shows the number of those who were killed outright, or who died on the battlefield, in every one hundred struck. Viewing the line as a whole, it will be seen that it runs a fairly straight course. The highest mortality is shown in the Russo-Turkish War, where, in every 100 men hit, 21.5 were killed outright. The high immediate mortality in this war was undoubtedly due to conditions incident to methods of attack, the Russians storming many fortified places at comparatively short range. The somewhat high mortality of the Crimean War is probably to be ascribed to the

fact that it was mainly fought in entrenchments where the men frequently received fatal head wounds. Of all the wars charted, the American Civil War may be taken as the most typical of one fought under general conditions with the old rifle. In this war the immediate mortality was 15.2 per cent.; this mortality being within a fraction of 1 per cent. of that of the Austro-Prussian War, and the Franco-German War, both of which are also fairly typical of wars fought under general conditions with rifles firing the older projectiles.

By comparing these figures with the immediate mortality in the Spanish-American War, the war in the Philippines, and the Anglo-Boer War, in which modern rifles were used, we see that the immediate mortality of the wounded in these wars is practically the same as that of the American Civil War, Austro-Prussian, and Franco-German Wars—the Spanish-American and Philippine Wars being within a fraction of one per cent. of the immediate mortality in the American Civil War and the Anglo-Boer War up to April 8, 1900, being only about two per cent. higher. These figures seem to point conclusively to the fact that the immediate death-dealing properties of the modern rifle may be considered practically identical with those of the older weapons.

The interesting question now arises, in what manner the modern rifle produces its immediate deadly effect? In the Spanish-American War the location of the fatal wounds was stated in 64 of the cases killed in action. Of these, 28 were due to gunshot injuries of the head; 19 to penetration of the abdomen; 17 to penetration of the chest; and 1 each to injury of the thigh and leg. This number of cases is small, but is sufficient to give a fairly clear conception of how the immediate mortality occurs, and is graphically displayed in ratios of one hundred in Chart 2. (Chart 2.)

From this it will be seen that the mortality is in the following order: Head, abdomen, chest, extremities.

In considering in what way the wounds are immediately fatal, it is well to consider them in the reverse order to that of their fatality. In the wounds of the extremities, the immediate fatal results can be due to but one cause—hemorrhage. It will be seen that immediately fatal results from wounds in this region are necessarily few, as they must depend entirely upon wounds of large blood vessels, the regional probability of which is comparatively small.

Immediate fatal results in wounds of the chest are also undoubtedly due to hemorrhage. The frequency with which the chest is penetrated, and, when the heart or a blood vessel is not

injured, the wounded survive for a long time and often ultimately recover, demonstrates that unless the heart or one of the main blood vessels is cut, death is not immediate.

Immediate death in wounds of the abdomen must arise from two causes—hemorrhage, and shock; hemorrhage when a large blood vessel is cut and one of the intra-abdominal organs badly lacerated or torn, shock being an accompanying factor when important parts are struck.

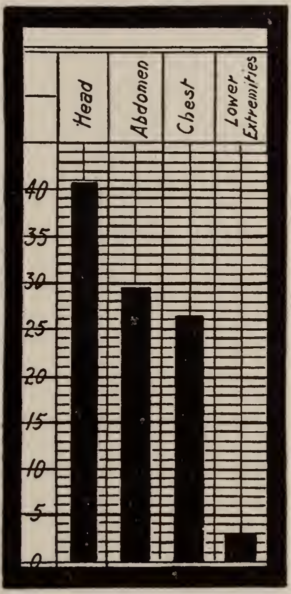

Chart II.—Showing regional proportion of immediately fatal wounds in the Spanish-American War.

Immediate death in wounds of the head is probably due to one of three factors, or a combination of these factors, namely, shock, hemorrhage or destruction of vital centers. Hemorrhage may arise from a wound of a blood vessel or from general disruptiev effects of the bullet; shock, from general disruptive effect; an injury to a vital center may be due, either to direct impingement of the missile, or to destruction of tissue produced by lateral transmission of the energy of a rapidly moving bullet.

The high mortality in wars in which the new rifle has been used as shown in Chart 2, conclusively demonstrates that the

small-caliber, mantled projectile is capable of producing fatal effects in a large percentage of cases where it strikes the head, abdomen, and chest. That these effects are produced by hemorrhage, shock, or destruction of some vital center is apparent, but in considering the causes which produce the remote mortality, conclusions are not so easily reached.

The remote mortality of the wounded, namely, the number of those who die after they come under treatment, is due, not only to the effects of the original traumatisms, but to various secondary causes which are influenced both by the nature of the original injury and by the treatment which the patients receive. In modern wars, two new factors have been introduced, each of which has probably done much to influence the rate of mortality of those not killed outright on the battlefield; these are the modern bullet and modern surgical methods. The mortality of the wounded is markedly lower since these factors have been introduced in war. This is shown by the line representing the curve of remote mortality in Chart 1.

This line shows that there has been a fairly gradual and steady decline in the number of deaths among the wounded who came under treatment in recent wars and that, co-incidently with the introduction of the new weapons and modern surgical methods, there is a decided fall. Thus, while the mortality in the English army in the Crimean War was over 12 per cent., of the French in the Franco-Austrian War, over 15 per cent.; of the Federal troops in the American Civil War, over 10 per cent.; of the Prussians in the war with Denmark, over 12 per cent., and the mortality in the Austro-Prussian, Franco-German, Russian-Turkish, and Chinese War in the neighborhood of 9 per cent.; the mortality in the Spanish-American War dropped to 5.7 per cent., in the Philippine War to 6.4 per cent., and in the Anglo-Boer War up to the present time to 4.6 per cent. The figures in the Anglo-Boer War cannot be considered conclusive, as they extend only to April 8, 1900, and it is probable that with the close of the war and the occurrence of all deaths in this class, the figures will be raised slightly and will closely approximate those of the Spanish-American War. These figures show conclusively the fact of the lowered mortality of the wounded who have come under treatment since the introduction of the modern rifle and modern surgical methods. In attempting to determine how much this reduction is due to either of these factors many difficulties are met; the main difficulty being that, as the modern rifle and modern surgical methods came into play together, it is difficult, if not impossible, accurately to estimate the respective part which each has played in lowering the mor-

tality. It seems to the writer, however, that some general conclusions may be reached.

These conclusions are arrived at by considering the regional mortality of remotely fatal wounds. Chart 3 shows the regional

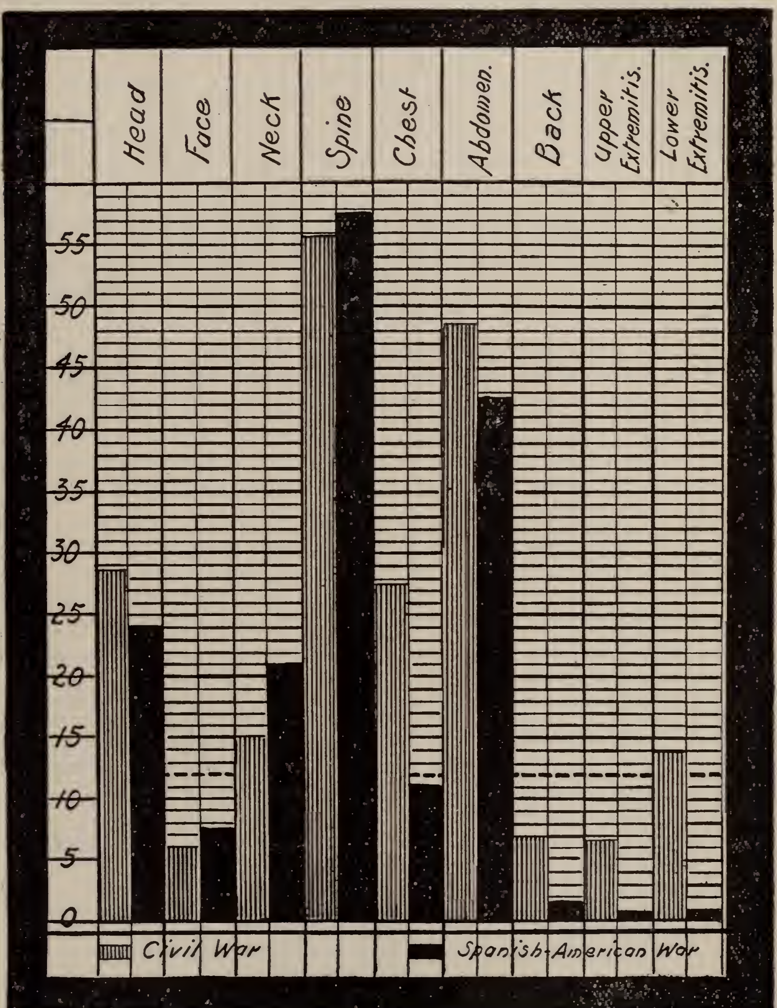

CHART III.—Regional mortality of remotely fatal wounds in Civil and Spanish-American wars.

mortality of the wounded who came under treatment in two wars; the American Civil, and Spanish-American Wars. In this chart in the regional mortality for the Civil War is given in white and for the Spanish-American War in black. The American Civil War is taken for comparison because it was fought under the conditions incident to the old surgery and the old weapons, while the large number of cases, nearly 250,000, of which the regional mortality is recorded, give accurate data for comparison. In the Spanish-American War there are but 1,262 cases so far published in which the regional distribution and the result as to death or recovery are given. While this number is small as compared with that of the Civil War, still it is sufficient to give at least general conclusions as to the regional mortality.

The first thing to attract attention in Chart 3, is that wounds of the spine, neck, and face were more fatal in the Spanish-American than in the Civil War. The difference is, however, not marked and it is possible that a larger number of cases would make the mortality more nearly similar. The next fact is that wounds of the head and abdomen are nearly, though not quite so fatal, in the Spanish-American as in the Civil War; so that in spite of the many remarkable cases of recovery recorded, where bullets have penetrated or perforated these regions, still, taking all the cases wounded, the mortality is almost as great as with the older weapons and older surgical methods. The third fact that presents itself is that the mortality has been greatly lowered in wounds of the chest, neck, and upper and lower extremities. Thus in wounds of the chest, the mortality has fallen from 28.4 per cent. to 10.9 per cent.; in flesh wounds of the back from 6.9 per cent. to 1.9 per cent.; in wounds of the lower extremities from 13.8 per cent. to 1.3 per cent., and in wounds of the upper extremities from 6.5 per cent. to 0.2 per cent. This chart at once demonstrates the lowered mortality of wounds of the chest and upper and lower extremities. It is probably fair to ascribe much of the lowered mortality in chest wounds to the action of the new bullet. Cases of recovery from wounds of this region without symptoms are numerous and the new bullet undoubtedly produces less traumatism in this region than did the older missiles. The same may probably be said relative to wounds of the lower and upper extremities, although modern methods of asepsis, antisepsis and conservatism have undoubtedly played a most important part. The lowered mortality of those wounded in these regions is most important in reducing the total mortality, as it is in these regions that the large percentage of wounds is received. The markedly lower mortality in these regions where the wounds are most numerous and aseptic and

antiseptic methods have the widest scope, has a decided effect in lowering the curve of the remote mortality.

The regional distribution of wounds was remarkably alike in the Civil and the Spanish-American War, showing that the regional distribution of wounds has not been much altered by use of the new rifle. See Chart IV.

It is of interest to observe that wounds of the spine were twice as common in the Spanish-American, as in the Civil War. This is to be accounted by the greater penetrating power of the new bullet, and the increased frequency of wounds of this region, together with their high mortality, is a factor in increasing the mortality of the new missile.

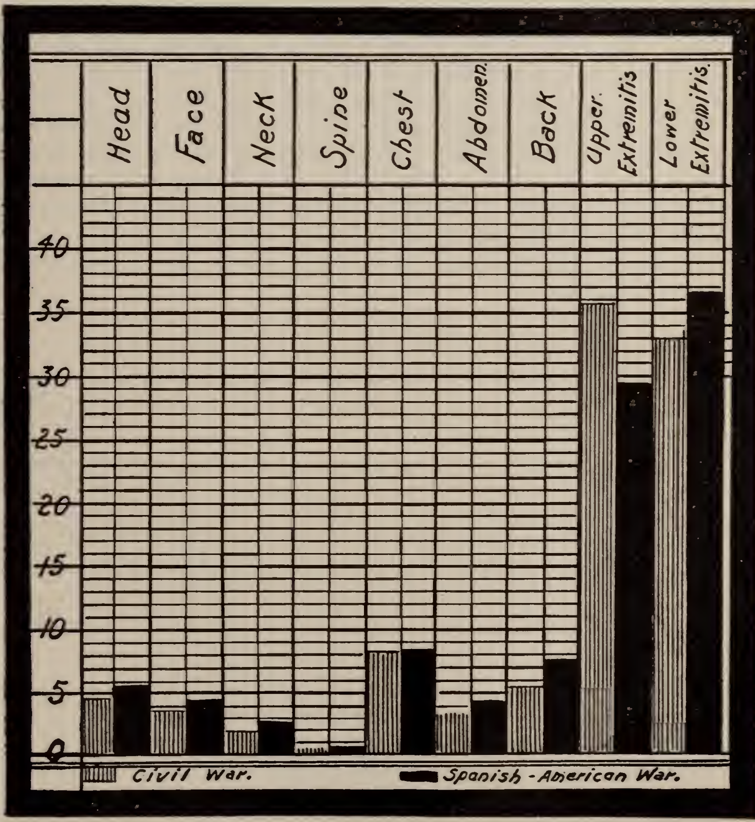

CHART IV.—Showing regional distribution of wounds in the Civil War compared with the Spanish-American war.

The question now arises: What conclusions relative to the military rifle now used are to be derived from the foregoing? It seems permissible to state that, so far as its immediate death-dealing properties are concerned, the new rifle is no more humane than the older weapons and that as many deaths on the battlefield may be expected where it is used as occurred when the older rifles were employed.

Relative to the remote effects which result from the use of the new arm, it is permissible to state that the deaths which occur later are much fewer than with the old weapon and that, therefore, the wounded have much greater chance of recovery, and that this humane result is due both to the new rifle and to modern surgical methods.

In brief, it may be stated that of every one hundred men struck by the new bullet, as many will be killed outright as with the old, but that many more of the wounded will recover, also, that recovery will be rapid in a great majority of the cases. Observers in South Africa state that it may be estimated that two-thirds of the wounded will be back on the fighting line in three weeks. It seems to the writer that it may be considered questionable whether a weapon which kills a large proportion outright, and which allows the speedy return of another large proportion to the fighting line, fully meets the requirements of a war weapon.

Godfrey's Method of Controlling Circulation in the Axillary Artery. Fig. 1.

Godfrey's Method of Controlling Circulation in the Axillary Artery. Fig. 2.

XXI. A NEW METHOD OF CONTROLLING HEMORRHAGE IN THE ARM AND AXILLA.

BY

GUY C. M. GODFREY,

CAPTAIN AND ASSISTANT SURGEON, U. S. A.

This method is to raise the arm upward, backward and inward as far as possible. When the limit of motion is reached, the pulse can no longer be felt in the axilla or below it. The exact position of the arm depends on the mobility of the shoulder-joint of the individual and a very slight movement either way will open or close the axillary when the limit of motion upward, backward and inward is reached.

Figures 1 and 2 show the difference in position necessary in different individuals. In muscular men it appears to be much easier to control the circulation in the artery than in stout or slender men. This leads me to believe that the circulation is obstructed by the mass of muscle pressing the axillary artery against the clavicle while that artery is bent over the bone. It has been suggested to me by Major J. R. Kean, U. S. V., that the cause of obstruction of the axillary artery in this position was the pressing of the artery against the tendon of the pectoralis minor or in the "V" formed by the junction of the pectoralis minor with the coraco-brachialis muscle. I do not agree with the latter view, as when the arm is raised, both tendons are much relaxed.

Having had no proper means of verifying the true cause of obstruction, the above are merely theories, which in time will be demonstrated.

This method has been tried in many cases with positive success every time. It is a quick and trustworthy means for controlling the circulation in the axillary artery and requires no cumbersome or expensive apparatus. If it is desired to keep the arm in this position for safety or operation, a clove-hitch is taken around the wrist with an ordinary roller or triangular bandage and tied under the opposite axilla. Owing to the stretching of the bandage, however, it will be necessary to tighten it up frequently, as in from thirty to sixty seconds it will have relaxed sufficiently for the pulse to be felt at the wrist. But with a Martin's rubber bandage, such as every Hospital Corps pouch is supplied with, it is not so. It has been demon-

strated in the hospital, at Pinar del Rio barracks, Cuba, that the Martin rubber bandage applied with a turn over the elbow to hold it backward, would cut off the circulation in the axillary artery for twenty minutes or as long as the patient could conveniently bear it.

XXII. THE HYGIENE OF THE NAVY RATION.*

BY

HENRY G. BEYER,

SURGEON, U. S. N.

In recording some observations on the navy ration which the writer had an opportunity of making during last winter, he desires it to be understood at the outset that this paper is not intended to criticise adversely the present navy ration nor those who may be responsible for the same. Neither is it, on the other hand, the intention to look at things through the spectacles of that very engaging list of eatables which is passed around immediately, the moment the word "ration" is pronounced in certain quarters. We propose to look at the navy ration and its administration with unprejudiced eyes, armed only by a few simple but telling experiments. It does not require a great deal of experience to know that there is as yet a long way from a market or even a bill of fare to the inside of a man's stomach. If, therefore, it should suggest itself to the reader of this paper that certain steps on this way might put up with some very desirable improvements, let it be remembered that all such improvements have originated in criticisms prompted by the proper motives and rendered in the right spirit.

A ship's company is generally divided into a number of messes, each consisting of about twenty or more men, with its own cook and mess attendants. The quantity of stores served out to each mess by the paymaster of the ship varies, of course, with the exact number of men in a particular mess. There is on every ship a chief cook and several assistant cooks (?) attending, as well as they know how, to the preparation of the food; the mess

*ANNAPOLIS, MD., April 26, 1900.

Medical Director John C. Wise, U. S. Navy, 1120 Vermont avenue, Washington, D. C.

DEAR SIR:—In compliance with a request contained in a letter from Dr. Beyer, dated April 25th, I beg to inform you that the Institute will be pleased to grant you permission to republish in the Proceedings of Military Surgeons the article on Hygiene of the Navy Ration, by Surgeon H. G. Beyer, U. S. N., recently published in the Proceedings of the U. S. Naval Institute, and request that you kindly give the Institute credit for the original publication. Very respectfully,

R. H. JACKSON,

Lieut. U. S. Navy, Secretary and Treasurer.

attendants, or berth-deck cooks, having charge of the serving out of the food and, also, of the mess gear, its cleanliness, etc.

Long experience and observation having demonstrated the necessity for reorganization of this antiquated system of messing, a most laudable attempt was made quite recently to put into practical operation a "consolidated mess," one which is to include all the enlisted force on board ship with the exception of the chief petty officers.

Thus, the consolidated mess of the U. S. S. Indiana, as described by Lieut. B. C. Decker, U. S. Navy (Proceedings U. S. Naval Institute, No. 83, 1897), consisted of about three hundred and eighty men, a ship's cook of the first class, two cooks of the second class and four of the third class, a commissary yeoman, and a storeroom keeper. Without going into the details of its organization at the present moment, it will suggest itself to everyone having even but little experience with messing large bodies of men, that the proposition, made in this system of messing, to engage a higher quality of cooks and a better class of mess attendants than heretofore, is not the least important of its many good and admirable points. According to all accounts which we were able to gather, under the conditions of this consolidated system of messing, the men live not only better, but also cheaper. We shall find later on in this paper that this very general and very favorable conclusion finds some very interesting and firm support in the results of our investigations into the comparative food-values as existing in our unmodified navy ration furnished by the paymaster of the ship as compared to those of a mixed or combined ration, that is, one made up of a part of ship's ration and a part of food bought in the market out of the money obtained from commuted rations. In short, we are in a position to prove that the food-value of our ration increases in direct proportions to the number of ship's rations that are commuted; and this fact we are inclined to consider one of the strongest and most direct arguments in favor of the consolidated system of messing.

In view of our figures as regards the food-values of the ration alone, the most impartial judge would declare in favor of the commutation of all ship's rations; he would have the regular ship's ration, in its pure and unmodified form, relegated to the function of an emergency or iron ration, to be used only whenever ships are kept at sea and have, from necessity, no communication with any of the markets on shore. The physical condition of the men under such a system could not do otherwise but greatly improve.

Upon one point, however, the greatest possible stress should

be laid in any and every attempt at mess reorganization, namely, the quality of the cooks and mess attendants. The waste, owing to bad management from that source, is very large and most deplorable. The most hungry stomach will refuse to eat things, not so much because they are not eatable, but because they are neither cooked nor served in a manner sufficiently inviting. If one of the objects of cooking is to render the food more pleasing to the eye, more agreeable to the palate, improve its flavor as well as its digestibility, we see, in the first place, that three of the keenest of our special senses demand to be favorably influenced before this one of the special objects of cooking can be said to have been attained. Man may, from a chemico-physiological point of view, be compared to a machine, needing only certain quantities of fuel in order to do a certain amount of work; but he is, to say the least, a machine endowed with special senses and a will of its own. The social position of man in this respect makes, if at all, merely a difference in degree, not in kind. Cooking, furthermore, is to alter the texture of our food-stuffs so as to render them more easy of mastication and subsequent reduction to a fluid state in the stomach; that is, to render them more easy of a perfect digestion and assimilation. The average cook, therefore, besides having to be thoroughly drilled in the special methods of boiling, stewing, roasting, broiling, baking and frying the food, must be taught to pay some attention to the appearances of his products.

Fortunately, any man gifted with the average amount of sense can become a good cook or mess attendant and can easily satisfy all the above requirements, providing he is properly taught, trained, and intelligently and systematically supervised in his work.

The two following tables represent, in food-values, the rations served out to, and of the additional articles of food obtained by purchase and consumed by a mess of twenty men during a period of fourteen days.

In order to obtain a greater variety of articles of food for their table than that which they receive in the form of rations, and in order furthermore to take advantage of the fresh fruits and vegetables which the market offers at different seasons of the year, the men on board ship prefer to have one-fourth of their regular ration commuted; that is, converted into money. With the amount of money thus obtained, and as much more as each man is willing and able to pay into the general mess-fund, the men, simply buy those articles in the open market whichever they prefer. The twenty men under consideration then draw fifteen ($\frac{3}{4}$) rations; their food-value is represented in

TABLE I.—RATIONS SERVED OUT FOR FIFTEEN MEN IN FOURTEEN DAYS.

	Weight, kilos.	Proteids.	Fats.	Carbo-hydrates.
Fresh Beef...........	33.0	7.227	.297	.....
Canned Ham.........	11.5	2.760	4.197	.....
" Corned beef..	11.5	2.545	1.610	.....
Pork, Fat	6.5	.942	2.424	.....
Salt Beef.............	33.0	7.227	.297	.....
Butter	1.3	.11	1.196	.....
Bread..................	57.0	7.752	.427	33.630
Flour	9.0	.990	.180	6.408
Sugar	25.0	.35	.....	24.965
Beans	6.7	2.237	1.186	1.949
Potatoes..............	19.0	.380	.....	15.865
Canned Corn.........	2.0	.198	.92	1.368
" Peas..........	3.0	.660	.60	1.590
Turnips	7.7	.77	.15	.523
Cabbages	3.8	.190	.19	.296
Dried Fruit...........	1.3	.13	.....	.260
		33.244	11.990	86.834
Per man and per day..	....	.158	.57	.442

Besides, the men received hardtack which was not eaten; they also received and consumed: 2.9 k. onions, 1 k. pickles, 3 k. coffee and 1.5 k. of tea.

Allow 15 per cent. for bones.

Table I. Table II. shows the food-values of the articles obtained by purchase in the open market.

These twenty men obtain in ration-money for a period of fourteen days, 14 x \$1.35=\$19, and pay out of their own pocket an additional sum of \$23.75, making in all \$42.75. The cook, also a member of the mess, pays nothing into the fund, and, besides, draws the value of two rations for his services out of it, which amount equals for the fourteen days \$8.40, and which sum must, consequently, be deducted from the money spent for food, leaving a mess-fund of \$34.35. This brings the money value of the mess shares per man and per day down to 13 cents.

The following Table, III., is intended to show in a condensed form the relations which the different values bear to each other:

The first four items on Table III., being perfectly plain and simple, need no further explanation, but the other four, perhaps, need a word or two more. Item 5 represents the value in food-material received daily by each man under the combined system;

TABLE II.—ARTICLES OF FOOD, OBTAINED BY PURCHASE, IN FOURTEEN DAYS.

	Weight, kilos.	Proteids.	Fats.	Carbo-hydrates.
Beef	10.2	2.040	.357	.....
Ham	10.2	2.448	3.723	.....
Pork, fresh	6.0	.870	2.238	.....
Corned Beef	3.5	.815	.490	.....
Bacon	14.4	1.247	10.555	.....
Milk, condensed	6.7	.824	.737	3.272
Eggs, Nos. 288	14.4	1.944	1.670	.....
Liver	3.5	.700	.140	.....
Lard	5.7	.154	4.674	.....
Sugar	6.2	.35	.....	6.165
Bread	49.0	3.920	.735	24.098
Oatmeal	4.8	.604	.268	3.024
Rice	1.3	.91	.11	1.006
Beans	16.3	4.238	.326	8.802
Potatoes	86.4	1.728	.172	18.144
Tapioca	1.3	.10	.....	1.084
Macaroni	1.3	.117	.4	1.001
Hominy	1.0	.120	.20	.710
Codfish	1.3	.351	.5	.....
Peas, canned	7.2	1.584	.154	3.816
Tomatoes, canned	7.2	.....	.....	.....
Summary	....	22.244	23.179	67.312

TABLE III.

	Proteids.	Fats.	Carbo-hydrates.
1. Food-values of articles obtained by purchase	22.244	23.179	67.312
2. Minus 10% of intestinal waste, leaves	20.020	20.062	60.581
3. Food-values of articles received in ship's rations	33.244	11.990	86.834
4. Minus 10% of intestinal waste, which leaves	29.920	10.791	78.151
5. Combined values calculated per man and per day	181.0	110.0	495.0
6. After subtracting ¾ value of *full* and *correct* ration	107.0	38.0	300.0
7. Leaves individual values obtained by purchase, at $0.13	74.0	72.0	195.0
8. As compared with food-value of full and corrected ration at $0.30	142.0	51.0	398.0

that is, that quantity which he receives when he draws $\frac{3}{4}$ of his regular ration and buys the rest of what he eats. Item 6 represents the ration share in the combined value of food-material consumed by him. Item 7 represents the share obtained by purchase. Item 8 gives the corrected sum in food-material which a man would receive daily at a cost of 30 cents, if he would live on his ship's ration alone. A man's daily expense for food, under the combined system, is $35\frac{1}{2}$ cents, or $5\frac{1}{2}$ cents more than the value of a ship's ration. If we now compare the food-value contained in the full ration at 30 cents per day, with the food-value of that part of the combined ration which the men obtain by purchase at 13 cents per day, we will find that the latter is quite a little less expensive than an equal share of the ship's ration would be.

If the men, namely, commuted all their ship's rations and bought food at the same ratio as above, they would obtain an amount of food the value of which would be equal to, proteids, 171; fats, 167, and carbohydrates, 450; or about one-fourth better than is the value of the ration for the same amount of money which the ration costs them, or 30 cents a day.

It is but fair to mention that, in this estimate, we have not included the hardtack which, though not eaten by the men, is furnished them in the regular ship's ration. Inasmuch as we wanted to get at the food-value of those substances which were actually consumed by our men, these, however, refusing to take the same, we were naturally obliged to leave it out of our calculation. But even if this was considered a part of what the men had received, it would scarcely invalidate the conclusions reached, since the proteid value and the fat value of the ration, which are the most expensive part of it, would thereby practically remain uninfluenced. When our ration is examined more closely it can easily be seen that it is rich enough in carbohydrates without the hardtack, and the instinct of the men simply made them refuse it, because there was no need of it.

So far, however, we must admit that our estimates are only approximately true, and a closer investigation becomes extremely desirable. Fortunately, the Germans have furnished us with a method of doing this.

For the purpose of having a more uniform standard for comparison as regards the difference in money-values existing between different diets or rations, and because of the fact that one part of proteid is not exactly equivalent to either one part of fat or carbohydrate, the Germans have created a "nutrient unit" for food-stuffs, based upon the market value of the different articles

of food. In accordance with this standard of the price of food-stuffs:

1 part of carbohydrates has the value of 1 nutrient unit;
1 part of fat has the value of 3 nutrient units;
1 part of proteid has the value of 5 nutrient units.

From this it is easily seen that proteids are the most expensive, while carbohydrates are the least expensive of food-stuffs, and this is true the world over.

Let us now calculate the nutrient units of the several rations which we wish to compare according to this standard, and contrast the results with the money-values for which each may be obtained:

The number of nutrient units contained in the corrected ration to be obtained from the ships' stores per man and per day for 30 cents is 1261. The number of units which the men obtained for themselves at the rate of 13 cents per man and per day amounts to 781. For 30 cents, or the value in money of the regular ration, the men could have obtained an amount of food containing 1802 nutrient units, or about one-third more than they received for the same amount of money in the form of rations from the ships' stores. Expressed in a still more simple manner, one cent will only buy 42 nutrient units in the form of ship's rations, while the same cent would buy 61 nutrient units in the open market.

The question might be asked: Is our ship's ration, in the quantities that are furnished to the men, insufficient in nutritive value, and is this perhaps the reason why these men prefer to have part of it commuted, instead of living on the same exclusively? For although the extra expense connected with the combined system of messing is small, it is still large enough to deserve consideration, and, I am sure, no sailorman, extravagant though he may be in some respects, would incur it if he did not *feel* that it was a necessary expense and money well invested. In order to answer the above question satisfactorily, we will now have to consult some of the results of the investigations of physiologists with regard to this subject.

We find that, for the purpose of maintaining life in a perfectly normal state, we need certain definite quantities of proteids, fats and carbohydrates mixed in certain proportions. Any human being fed exclusively on a fatty diet must finally perish from the want of nitrogenous food. In the same manner an individual fed exclusively on carbohydrates will inevitably incur the same risk.

After much experimentation and the most painstaking and laborious investigations on the part of both hygienists and physi-

ologists, it is estimated by Voit that a laboring man, working from 9 to 10 hours a day and weighing on an average from 70 to 75 kilos, requires 118 grams of proteids, 56 grams of fat and 500 grams of carbohydrates.

The regular ship's ration, exclusive of hardtack, pickles, coffee and tea, gives us a nutritive value corresponding to 142 grams of proteids, 51 grams of fats and 398 grams of carbohydrates, a nutritive value which makes the ration superior as regards proteids, equal in fat-material and also superior in carbohydrates, providing we include the hardtack in the diet, as compared with the diet demanded by Voit for the laboring man of an average weight of 70 to 75 kilos. This estimate of Voit is the most accurate one attainable, and stands in almost perfect agreement with the estimates of all those authorities in scientific physiology and hygiene who have given this subject the most careful attention, excepting perhaps, minor differences as regards fats and carbohydrates.

It is considered that an allowance of 118 grams of proteids is a most generous quantity and that a man—our average man, for instance—can exist on considerably less than that amount. But we find on comparison that the nutritive value of our ration is equal to 142 grams in proteid material, or 24 grams more than is asked in the above generous allowance made by Voit.

The average man of Voit is one weighing from 70 to 75 kilos. Consulting our table of weights, we shall find that our average man weighs, in round numbers, only 65 kilos, or from 5 to 10 kilos less. It is perfectly well known that both the amount of mechanical work performed by a man, and, the amount of heat produced by him, stand in a certain definite relation to the weight of that man, and, consequently, also the amount of food which he consumes. *Ceteris paribus,* we may assume that our average man of 65 kilos needs less food than Voit's average man of 75 kilos. All the men on whom these observations were made belong to a gunnery class, undergoing instruction in the construction and usages of modern guns, which is, as the men have frequently confessed themselves, light work when compared with that which they would have to do in the average cruising ships, or with that which a laborer performs who is steadily at work for 9 to 10 hours a day. Consequently, our navy ration ought to be not only perfectly sufficient in its food-material, both quantitatively and qualitatively, but must be considered a generous allowance. And this fact also is freely admitted by the men themselves. The answer to my questions in this regard which I most frequently receive from the men is: It is enough, *but* . . . and there follows a pause.

Thus, in spite of this generous sufficiency as regards the quantity and quality of our navy ration, we must still admit the existence of a number of good and sufficient reasons on the part of the men for wishing to commute part of their rations.

Referring to Table III., item 5, we shall observe that under the combined system of messing, the daily food-supply per man is, on the average, equal to 181 grams in proteids, 110 grains in fats, and 495 grams in carbohydrates. This result of our calculation has been attained after making due allowance for all possible loss which might be incurred in the handling of the raw material of the different food-stuffs, and also after deducting the weight in bones and other waste from them. But allowing for the sake of argument, if for nothing else, even an additional loss of, say, 30 per cent., owing either to ignorance of cooks or to habits of wastefulness, we should still have left a diet consisting of 127 grams of proteids, 54 grams of fats, and 347 grams of carbohydrates; a diet more than equal in its proportionate nutritive value for our man of an average weight of 65 kilos and doing light work to that required by Voit for a man of 75 kilos in weight and working steadily for from 9 to 10 hours a day.

The most obvious conclusions that we can come to from the above method of reasoning are that the men do not get what they buy, or, if they get it, they receive it in such a form that they either cannot eat it, or, if they eat it, do not assimilate it. For if these men really got what they bought and properly assimilated it—converted it into flesh and blood—we should necessarily be led to expect a corresponding increase in their average weight, considering that their work was light and the demand for energy small.

Looking at the table of weights of the forty-two men, in which number our twenty men are included and all of whom belong to the same gunnery class, practically all living under the same identical conditions and circumstances, we find, during the four months when their weight was taken at stated intervals, that they have made but an average increase of 0.4 kilos or not quite a pound. We can, therefore, only say that these men have merely held their own for a period of four months, and that in spite of their living during all this time as regular and orderly a life as men can live, and under the most favorable conditions not only of work but also as regards environment and climate.

The above-mentioned conclusions will find still greater support when the following calculations will have been considered:

It is well known that food-stuffs, when burned, develop different quantities of heat. Thus, the greatest amount of heat is

developed by the fats, while the proteids and the carbohydrates are about equal in this respect. It is generally accepted as a well-established law in physiology, that the calorimetric values of the different articles of food determine also their respective physiological values as nutritive substances of the body.

Thus, one gram of fat produces 9.3, one gram of proteid and one gram of carbohydrate each 4.1 large calories. Whenever fats and carbohydrates are burned or oxidized within the body, their calorimetric values are absolutely equal to their physiological values, because both of these substances are completely oxidized to form water and carbon dioxide. The physiological value of the proteids, on the other hand, remains behind the calorimetric value because proteids are not completely burned within the body; the remnant being urea. It has been estimated that the physiological value of the proteids is only from 72 to 78 per cent. of their calorimetric value. Practically, one-third of the calorimetric value of proteids is deducted in the calculations for their physiological value in order to cover the loss both in urea and the small portion of nitrogenous substances lost in the fæces. According to Rubner, 100 grams of fat are isodynamic with 225 grams of proteids or 240 grams of carbohydrates respectively.

According to these figures, the amount of energy conveyed to our bodies in the form of food, providing the quantities ingested are known, becomes a matter of easy calculation. This energy may, furthermore, be expressed either in terms of heat-units or calories or in terms of mechanical work, since one *large* calory, or that amount of heat which is necessary to raise the temperature of one liter of water by one degree C., corresponds to 425 units of mechanical work; in other words, that amount of energy which is sufficient to raise 425 grams in weight to the height of one meter.

The food-stuffs with which we nourish our bodies must, then, first of all, supply the demands for the amounts of energy made upon us. A fully grown adult individual uses up, according to his occupation or the amount of work which he performs, from 2,400 to 3,000 large calories during twenty-four hours. Consequently, his diet must consist in food-material possessing *at least* a calorimetric value equal to that amount. More, of course, would be required by a growing body or by one under any great physical exertion.

The calorimetric value of the ration required by Voit for his average man, weighing from 70 to 75 kilos and working from 9 to 10 hours daily, equals 3,055 calories. The corrected navy ration (item 8, Table III.) amounts to 2,696 calories. The com-

TABLE IV.—WEIGHTS.

Name.	Age. Yrs.Mos.	Date of Examination. Nov. 23.	Dec. 11.	Jan. 11.	Feb. 25.	Gain.	Loss.
Nolan, M. J	24, 7	62.7	61.3	64.1	64.1	1.4	----
Kohler, F. J	29, 4	67.3	67.5	67.7	66.8	----	0.5
Damon, E. J	25, 8	67.7	67.0	67.0	67.0	----	0.7
Danielson, C	25, 5	62.7	62.3	64.1	64.1	1.4	----
Wolf, W. F	25, 1	63.6	62.3	63.2	64.5	0.9	----
Stickney, F. G	30, 2	62.7	65.2	65.0	65.0	2.3	----
Harmer, W. P	24, 8	58.6	60.6	61.3	62.2	3.6	----
Clark, B. H	25, 11	62.7	62.7	62.2	61.3	----	1.4
McMullen, E. B.	23, 11	59.3	59.2	62.3	61.8	2.5	----
Fox, R. W	23, 10	68.0	69.1	67.0	70.0	2.0	----
Johnson, C	33, 8	75.2	72.7	73.2	72.3	----	2.9
Frederickson, F	32, 4	59.5	60.2	60.2	60.9	1.4	----
McCrea, F	28, 1	65.0	64.5	66.4	65.9	0.9	----
Ryan, D	26, 7	62.3	63.2	63.2	64.1	1.8	----
Sherwin, E	20, 10	69.7	71.3	71.3	74.1	4.4	----
Wade, C	26, 0	53.4	52.3	53.6	52.7	----	0.7
McQuade, F	30, 4	61.1	63.2	63.6	59.1	----	2.0
Smith, B	24, 1	53.0	53.0	53.0	53.2	0.2	----
Shepley, B. H	23, 0	55.4	55.4	56.8	55.9	0.5	----
Hansen, H	29, 11	71.8	71.8	73.4	71.8	----	----
Heyden, J	26, 2	69.1	69.5	71.8	69.0	----	0.1
Brownlee, W. J	25, 8	65.4	66.8	66.8	65.4	----	----
Hurdle, O. F	23, 3	68.0	67.0	67.0	68.2	0.2	----
Pollard, G. A	26, 2	69.1	69.1	69.8	67.3	----	1.8
Hicks, C. T	38, 6	67.3	69.8	71.0	70.0	2.7	----
Doulon, P	32, 11	68.2	70.0	69.5	68.6	0.4	----
Creelman, N. J	23, 3	59.5	59.1	60.4	59.0	----	0.5
McNally, F. J	26, 8	64.0	63.4	62.5	63.6	----	0.4
McQuay, S. C	28, 10	61.6	59.5	60.4	61.3	----	0.3
Svenson, A. J	23, 1	62.3	61.8	62.7	63.6	1.3	----
Crone, C	24, 7	58.0	55.0	58.0	55.0	----	3.0
Herbert, P	28, 0	66.0	66.6	67.5	66.0	----	----
Linden, K. F	30, 1	63.6	63.2	64.8	64.1	0.5	----
Bottcher, R. D	23, 6	63.6	62.0	64.5	64.1	0.5	----
Jacobus, F. W	23, 2	67.5	66.1	66.8	67.0	----	0.5
Mills, R. H	27, 1	67.5	70.0	71.8	68.1	0.6	----
Kraczewski, B	32, 2	80.6	78.2	81.1	79.0	----	1.6
Brewster, C	29, 11	64.5	65.9	67.3	66.8	2.3	----
Pederson, C. V	25, 7	65.0	65.0	65.0	64.1	----	0.9
Kennedy, J. M	23, 9	57.3	59.1	60.4	60.4	3.1	----
Lemieux, S	32, 3	60.0	59.1	59.1	56.8	----	3.2
Morey, A. L	23, 2	54.1	54.1	56.8	57.3	3.2	----
Average	27, 5	64.0	63.9	64.8	64.4	0.9	0.5

bined ration (item 5, Table III.) on which our twenty men have presumably subsisted, comes up to 3,805 calories. The combined ration, less 30 per cent., which they probably subsisted on, in

reality, gives us 2,664 calories; and these estimates seem to agree with the actually observed facts as closely as could possibly be expected.*

In other words, the demand on the men's energy amounted on an average to 2,664 calories, and they took just sufficient food to supply this demand, and the rest, if there was any, was wasted for reasons of poor cooking and of serving the food in an uninviting manner.

To summarize, the following conclusions seem to be justified by the above investigations, namely:

1. Consolidate the number of small messes on board ship into one general mess.

2. Train the cooks in the art of good and economic cooking and supervise their work on board ship.

3. Commute all ships' rations whenever communication with the markets on shore can be established, as recommended in the "consolidated mess system."

4. Relegate the present ships' ration to the function of an emergency or "iron" ration, to be used only in cases of necessity, or whenever communication with the markets on shore is out of the question for good and sufficient reasons.

5. Authorize a war ration.

*It is not an easy task to determine, in a more direct manner, the work done by a man in 24 hours. This is, however, comparatively speaking, easy in the case of a man's walking or marching. In walking it is equal to 0.07 k. p, where k is the body-weight, p the number of steps taken, providing the walk was taken on a horizontal path. While marching, of course, the weight of the accouterments is to be added on to the body-weight; and, if any heights are climbed, these also must be added on to the results of the calculation.

XXIII. THE PHYSICAL FACTOR IN EXAMINATIONS FOR THE ARMY AND NAVY.

BY

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In countries like America and England, in which the military and naval services are not made compulsory as in Germany, France and other countries, enlistment in the army and navy operates on a principle of natural selection, supplemented by a more artificial form of selection, done by the various recruiting officers. It ought, therefore, surprise no one to find, for example, in both branches of the service in this country, a rather superior lot of men, providing that one principle of selection is not allowed to interfere with or counteract the other and that, on the other hand, both principles be made to operate in the same sense. Important as this is, in view of the composition of our forces at sea or on shore, this seems not always to be the case.

Without dwelling on the injurious influences brought to bear upon the composition of our forces by our political friends, it has frequently occurred to me, in connection with my duty as recruiting officer, that much improvement would be derived as well as better results obtained from the consultation of an accurately prepared standard for comparison. The absence of such a standard of comparison, in the shape of measurements representing the typical or ideal soldier or man-of-war's man, it seems to me, must have been often and very keenly felt, long before this, by every conscientious medical recruiting officer. For, the inference seems but natural, namely, that, before making a proper selection from a number of men for the military or naval service, we would have to begin by knowing, first of all, what sort or description of an individual we mean to select or are in need of. This feature must, therefore, be regarded as of fundamental importance.

In view of this important problem, the navy department has recently caused to be inaugurated a new method of examining boys for positions as navy-yard apprentices. This method has worked so admirably in practice and is so well adapted to the purpose that an account of it seems to be desirable; all the more so, since it seems capable of a much wider application to all branches of the service. Since the principles of its wider appli-

cation to the services will be found not only in the method itself but also in the results that have so far been obtained with it, a full account of both seems to be called for.

The government, in providing an examination for applicants for positions as apprentices in the different shops of navy-yards, secures thereby several important objects and advantages. The mental portion of such an examination, supposing it to be properly conducted, will insure a higher degree of intelligence among the workingmen of the future, consequently a better quality of work done in all the different departments of navy-yards.

The physical portion of the examination, as a means of selecting none but physically fit subjects for these positions, contributes, moreover, towards increasing, very materially, the value in time and money which is invested in these boys, by teaching them a trade, on account of the obvious fact that the average life of the boys, thus selected, will naturally be longer than that of the physically unfit and, hence their usefulness is more prolonged.

"Navy Yard Order No. 14, Revised," requires that each applicant shall receive a *mark* for his physical examination. With reference to marking any one from a physical examination, there had never before been any system in vogue either in the navy or elsewhere, by means of which a candidate was given a definite mark, expressed by a number and which should count as a factor in the sum total of his entire examination and, thus, be made the means of materially assisting him in, or preventing him from, getting a desirable position. This expresses the kernel of the nutshell and everything else, having a bearing on the problem, gravitates around this central idea.

Heretofore, a candidate for any position in the Navy, including cadets, was found either fit or unfit, was either accepted or rejected accordingly, on physical examination alone without there being any fixed or well-defined standard of marking. In the case of an examination being required, the marks obtained in the mental were the only ones that counted.

Physical excellence being so obvious a factor in the general make-up of the personnel of a service like the Navy, it had long since seemed to me desirable to establish some standard which would be absolutely accurate and calculated to serve as a means of giving a boy, be he cadet or apprentice, credit for the physical advantages or disadvantages which he possessed in such a manner as to permanently influence his career and without, at the same time, doing him the least injustice. Knowing, moreover, that his physique would count at every step in his promotion, it would serve as the very best stimulus for the boy to im-

prove the same whenever and wherever opportunity was favorable for doing so.

After some thought on the matter, it occurred to me that the only available method for the present was to make use of the percentile grade system and the normal growth, and development tables, published by me some years ago in the Proc. of the U. S. Naval Institute, No. 74, and give each boy the number of the physical percentage into which by nature and according to accurately determined measurements, he belonged. For the sake of convenient reference Table XIX. is hereby reproduced.

TABLE XIX.—HEIGHTS IN PERCENTAGES.*

Age at nearest birthday.	No. of observations.	Values in inches at the following Percentile Grades.										
		5	10	20	30	40	50	60	70	80	90	95
15	131	59.507	60.310	61.563	62.553	63.457	64.290	64.855	65.764	66.653	67.717	69.290
16	395	61.750	62.549	63.714	64.580	65.250	65.805	66.455	67.200	68.020	69.000	70.406
17	722	63.130	64.217	65.165	65.853	66.434	67.000	67.626	68.317	69.100	70.320	71.320
18	841	64.193	65.000	65.886	66.483	67.044	67.633	68.251	68.920	69.665	70.520	71.530
19	750	64.680	65.391	66.250	66.844	67.424	67.651	68.600	69.243	69.786	71.000	71.880
20	645	64.962	65.543	66.413	67.094	67.675	68.252	68.810	69.477	70.253	71.280	72.120
21	493	64.970	65.620	66.433	67.054	67.667	68.215	68.852	69.483	70.180	71.120	72.000
22	328	64.945	65.831	66.580	67.200	67.762	68.352	68.960	69.927	70.632	71.543	72.258
23	232	65.287	65.800	66.580	67.300	68.010	68.522	69.030	69.625	70.307	71.240	72.000

*See Beyer—U. S. Naval Inst. Proc. No. 74.

Method.—The method, though simple, had perhaps best be exemplified by a definite case: A boy's age is calculated from the nearest birthday and found to be fifteen; he is measured in the usual manner and his height standing recorded as 64.3 inches. What is his mark for height? Consulting Table XIX., and finding the recorded heights opposite the fifteen year old boys, we follow it from left to right until we come to the figure 64.29 inches which is the nearest to our boy's recorded height; the percentage number, found above this value on the table being 50 inches, it is the mark which the boy is entitled to receive for his height; he is an average or mean boy for his age so far as height is concerned.

This same process is followed out in trying to find the percentages of any of the other measurements or dimensions, that it is desired to include in the examination, by simply referring, after the same manner, to the respective tables exhibiting them, arranged according to percentile grades. Height, weight, chest circumference, being the bearing dimensions, these were the only ones made use of in the present instance. The percentage values ascertained and calculated after this manner are now added together and averaged; this average constitutes the boy's mark for his physical examination.

There is, however, one item for which percentile grade tables do not exist but which, nevertheless, must be incorporated in the final physical average mark. This item we have termed "General Health," and its value is ascertained through an examination which is chiefly medical in character. The principal factor in this is a good heart and a sound pair of lungs; a secondary factor is as to whether a boy approaches or not the percentile grade in which he appears to belong with regard to the average obtained from the largest number of the most important portion of his dimensions. A boy, for example, whose height puts him into the 75th percentile grade, but whose chest girth places him in the 25th grade would not be entitled to get the mathematical average of these two numbers, namely, 50. His development would seem rather abnormal and therefore 35 would be a better number for such a case. Any disease of either heart or lungs, of course, would reduce his physical mark to an absolute zero.

So much by way of a description of the method, and there remains now only a brief mention to be made of the results obtained with it.

In accordance with the principles of the method, described in the preceding pages, seventy-six boys of an average age of sixteen years were examined in the Boston navy yard several months ago. The mental examination consisted in a written as well as an oral examination and included spelling, simple arithmetic, also decimals and the rule-of-three, 100 being considered perfect. All the boys had left school two years previously, on the average, and been engaged in various occupations since that time; they all belonged to about the same social class of people and lived in the closest vicinity of Charlestown.

The adjoining Table I. is intended to show how the results of the combined examinations were finally calculated and in accordance with which each boy received his final mark:

TABLE I.

William B.	Mark x.	Multiple.	= Total.
Physical	50 x	3	= 150
Mental	75 x	5	= 375
Oral	83 x	2	= 166
Total	-----	--	691

Both examinations having been completed, all the seventy-six boys were arranged in a table in the order of their relative

merit-marks, so that the boy having received the highest mark stood first on the list, while the boy having received the lowest number stood at the bottom of it. Dividing, now, the total number of the seventy-six boys into eight sections, with ten in each section except the last which had only six, and, finding the average of each section, we would, of course, expect to find that the first section would yield the highest average, while the last would yield the lowest average so far, at least, as concerns the column of totals.

The same result need not necessarily be here for the averages obtained from the column of physical marks. If, however, the physical composition of the boy has indeed any relation to his mental qualifications, if, in other words, there is such a thing as a psycho-physical correlation, then, indeed, we would expect to find, on comparing all the averages, that they would all show equally a gradual decrease in value from first to last. Table II. shows that this is indeed the case.

TABLE II.—TABULATED RESULTS OF AVERAGES.*

Ten.	Physical,	Mental.	Total.
1	296.	432	778
2	275.	350	680
3	232.	302	617
4	176.	282	566
5	160.	252	522
6	136.	202	483
7	105.	195	425
8	75.	144	316

* The oral was not included in this table because, according to the common consent of the board, it did not amount in value to a real examination.

In the average mark of the physical column were contained increments of height, weight, chest girth and general health. It was, therefore, of considerable interest to ascertain to what extent each of these four items contributed towards the general result. Suffice it to state here that they all showed a uniform share in this result.

Enough has been said with regard to the method and its results, of applying standard growth and development tables in the work of physical examinations at recruiting stations to show their purposes and uses. It has been shown that by the use of such tables we are better able to select precisely the men we want, getting not only a very superior physical lot of men, but

also securing at once a more brainy lot. The further application of the method in the examination of recruits for the Army and Navy would seem to be but a question of the necessary tables.

The tables that were used in the present instance were compiled from the records at the Naval Academy. They represent the measurements of the naval cadet under a six year's course of training and would, therefore, be applicable to naval cadets only. But similar tables may be made from the records of men before the mast as well as of soldiers. Tables representing the typical infantryman, cavalry man and artillerist, etc., as well as of the different divisions of men to be found on a man of war might easily be compiled from existing records. The necessity for producing accurate standards in the shape of such tables seems to me apparent and in the line of progress, improvement and of our duty. This needs no further argument, although much might be offered in such behalf.

If, for instance, the number of admissions to the sick list, the occurrence of preventable diseases and the mortality rate of our troops, during the Spanish-American War, could be ascertained separately for the regulars, the militiamen and the volunteers, a comparative statistical study would probably reveal the fact that the relative percentage of admissions and of the number of deaths of each of these three classes would increase as we proceed from the regulars to the volunteers. This is, of course, assuming that the conditions of the different classes of troops, from which the statistics were collected, were identical at the time. Although the unfavorable results of such a comparison might naturally be traceable to a great variety of causes, one, perhaps the principal one, of the determining causative conditions would, no doubt, be found in the physique of the men.

However that may be, it must be conceded that one of the most painful and striking lessons that we have learned or ought to have learned, from the last war is the great liability to exhaustion and disease on the part of the untrained and physically unfit man, suddenly taken from a peaceful occupation and plunged into conditions of actual war that are entirely new to him. This indeed constitutes one of the most serious drawbacks or objections to that form of raising troops, being not only attended, as it must be, with a very large loss of the bravest and most valuable men to no purpose whatever, a sheer waste as it seems, but also forming a serious menace to the health, prosperity and success of the regular troops.

We all know very well that a large and well-trained standing army, always ready to take the field at a moment's notice with a well-trained and organized sanitary service, would not be liable

to incur the same fatal dangers from paralysis from that source. It will, however, be a very long time before the people of this country will consent to provide and maintain such an army. We will, on the contrary, continue to call for volunteers in times of war until the condition of the present shall have undergone the changes of an uncertain and indefinite future so as to actually compel a reform in this respect. We are, consequently, dealing, for the time being, with an unchangeable condition and the question for us to answer is what, under these circumstances, is the next best thing that we can do to avoid the disasters and dangers that threaten and accompany the raising of raw recruits and turning them loose into the field with no time for either disciplining or training them. Can we who stand at the gates do something to avert at least in part such conditions in the future? I am strongly inclined to think that we can do our share, by following a more precise and accurate system of selection in the process of recruiting which shall be simple enough so that every physician, military or civil, will be able to apply it.

To this end we must begin by collecting the most accurate and precise records of measurements of the normal soldier; from these we must construct our tables. The mean, average, typical or ideal soldier will be easily found in them.

For, if you will grant that the combined educational forces at work upon the physique of the soldier under training, must finally result in a physique, at the end of the training period when he is considered an accomplished soldier, that is different from the physique of the farmer or the man behind the desk or counter, then it must also follow that a thousand soldiers who have been through a campaign or a course of military training, will give us average measurement, both linear and circumferential and average weights with plus and minus deviations from the average, that are different from those derived from similar measurements and obtained from a thousand farmers or office employes. Granting, now, further, that the proper and thorough training of a soldier for his particular calling will, in the end, result in a physique which is peculiar to the soldier and better adapted to his calling than it was before the training, then we also would possess in tables representing the average dimensions of a large number of such men a more precise and accurate index of what the physique of a soldier ought to be.

It is in this spirit and for these reasons that I would suggest to you the adoption and application of the method described in these pages, to the needs of the services at large.

XXIV. A TROPICAL RATION.

BY

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"Si la maison importe á l' hygiene des tropiques je n' hesite pas á affirmer que l' alimentation y est comme le fondement méme de cette science." (Treille, Hygiene Coloniale.)

In this discussion it is proposed to treat the question, the importance of which is not over-stated above, not from the point of view of the scientist, who deals in tables of relative proportions of proximate principles, and food values, but from the standpoint of the soldier who eats the ration, and the company officer who does the military housekeeping.

It will be assumed that the present U. S. Army ration provides an abundant and, in the main, satisfactory diet for temperate climates.

Starting thus from familiar ground we will undertake to determine:

I. What in general terms is the proper dietary for the tropics, and what are its essential differences from that of temperate climates.

II. In what respects must the present ration be modified to make it provide for, or permit of, a proper tropical dietary and so constitute an ideal tropical ration.

In connection with so rudely practical a machine as an army nothing is ideal which is not absolutely feasible, and so our ideal ration must be made to conform to reasonable limitations, as to cost, possibility of adequate supply, and other administrative considerations.

Before beginning the consideration of the proper tropical dietary it is well to point out the distinction between the ration which is provided and the dietary which is eaten.

Food purchased with the company fund, for example, is usually not a part of the ration, but it is a very important part of the dietary.

A few words on the subject of the *Flexibility* of the ration and the limitation thereof are also necessary.

The word flexibility as applied to the ration will be taken to mean the quality of providing for variety in the diet and to include not only the alternative issues provided by A. R. 1253,

but also the purchase of increased amounts of articles issued, and of articles not issued by means of a company fund.

The commutation of the ration at $1.50 a day to an enlisted man traveling alone, from which he may purchase whatever he likes, furnishes an example of the extreme of flexibility .

The travel ration issued to a company traveling by rail approaches the other extreme of inflexibility.

In European services where the service conditions are approximately uniform, and where local markets are always at hand, the system of money commutations is much used for peace conditions. For our service, with its frontier stations, and its widely varying local conditions, and local prices, such a system has been in the past inapplicable, and the flexibility necessary to escape a repellant monotony of diet has been gained by the familiar expedient of a company fund created by the sale of parts of the ration which are not at the time desired. This, in practice, is equivalent to an optional money commutation of the articles on which a saving is permitted, while the presence of the components of the ration, at hand, if they are desired, secures the soldier against the inconveniences of an ill-supplied or extortionate market.

The articles on which the saving has always been chiefly made are bacon or pork, coffee, and, through the post bakery, flour.

From the regularity with which a well administered company makes a saving on these articles it might be inferred that the ration is in these respects too lavish, but this will be seen not to be true when it is observed that practically no savings are made in these or other components in the field under the conditions of active service.

The American soldier, unlike the European, receives in time of peace and in garrison a ration which is adequate for war conditions also. He is likewise more fortunate in that his pay is not laid under contribution to assist in feeding him.

The special conditions of the naval service make it practicable to employ in the U. S. Navy a much more extensive use of the system of money commutation than is practicable in the army.

The flexibility of the ration has been markedly increased and a valuable addition made to it during the past year in order to meet the new requirements of colonial service, by G. O. 78, A. G. O., 1899, which permits a savings to be made on fresh beef and adds two ounces of dried fruit to the ration. Unfortunately certain restrictions are placed on this savings, as the provision,

that its money value must be taken in ham, or other articles of sale, and its limitation in amount to one-seventh of its issue.

The proposed changes in the ration refer, it must be understood, almost entirely to the dietary of garrison life, which is the normal life of the soldier.

The limitations of field service are so narrow and so strict that there is little latitude. Bacon, biscuit and coffee must be the soldiers' fare, and the variations of the diet must come chiefly by individual or company purchase, for which he should receive a liberal cash commutation for the parts of the garrison ration which he does not receive.

I. Tropical diet:

The three proximate principles are classified as:

Fat, the heat food.

Proteid, the tissue food.

Carbohydrate, the work food.

Atwater gives the amount of each consumed by the average American, with average work, as:

Proteid 125 grams, fat 125 grams, carbohydrates 450 grams.

"Cold increases the oxidation of the non-proteid material in the body, the increase being in a general way proportional to the fall in temperature. Conversely a rise of temperature causes a diminution of oxygen consumption and co-elimination. The proteid material in the body is not affected."—(Amer. Text-book of Physiology.)

As of the non-proteid principles fat has, compared with carbohydrates, a heat forming value of 2.2 to 1, the reason for the well known fact that less fats are needed in hot climates than cold ones is sufficiently clear.

There are in addition hygienic reasons why the carbohydrates should to a great extent be substituted for the fats in accordance with the law of iso-dynamic equivalents.

The digestion is weakened in hot climates and the liver is more inclined to torpidity. Fats are more difficult of digestion and absorption normally than carbohydrates, and when freely ingested in the tropics are extremely apt to split up in the stomach into butyric, caproic, lactic and other irritating acids, producing a condition of hyperacidity of the stomach contents, which the diminished secretion of the torpid liver is unable to neutralize and render alkaline.

As the intestinal digestion cannot proceed in the presence of an acid reaction, the condition commonly known as "biliousness" results with putrefaction of the intestinal contents and the product of skatol indol and various other poisonous alkaloidal fermentation products.

A catarrhal inflammation of the bowel results, with diarrhœa. This diarrhœa is at first of advantage in eliminating the poisons but under the irritation of unsuitable diet the inflammatory condition is apt to continue and increase, running into the exhausting and dangerous diarrhœa or dysentery which is so familiar to the military surgeon in the tropics.

It is certain that the inhabitants of warm countries eat less meat than those of cold countries, and the amount of proteid taken is derived to a greater extent from the vegetable kingdom, as from the leguminosæ. Physiologists and physicians, as a rule, state that less proteid is needed. This is on the other hand combated by some who maintain that less meat is eaten by tropical people because they are as a rule poor populations who cannot afford it, but that they gladly eat meat, when they can get it, in preference to a less stimulating diet.

Some observers who have seen in Cuba and Porto Rico the anæmic and dropsical victims of ankylostomiasis, have jumped to the conclusion that a stimulating meat diet is especially needed in the tropics. It is evident, however, that our English cousins in Jamaica, and other tropical stations, do not suffer from lack of proteid diet, yet their meat ration, both at home and in the tropics, is only three-fifths of ours, viz: twelve ounces. If our meat issue were reduced to this, it is certain that our troops would not suffer in nutrition but would gain in health.

Treille, after showing that the diet of tropical peoples in Africa, Asia, Malaysia, Central America and Polynesia, is chiefly vegetable, the meat eaten being mainly fish, says: "In conclusion, the peoples indigenous to tropical countries are above all, but not exclusively, vegetarians. These habits do not proceed, it should be observed, from a backward civilization. For the great oriental law-givers, who were true hygienists, took care from the most ancient times to forbid by religious laws the abuse of animal diet. This was because they had cogent reasons for doing so and these were drawn from experience. They knew that too carnivorous a diet disposes in warm climates to certain diseases and they had reason to fear that these would result in injury to the development of the race or nation. Hence we find the prohibitions of the Mosaic and Mohammedan law, and likewise of the Vedic, Brahmanic and other religions of India where the Aryan race established so enduring a foothold.

"Of course the day has passed for imposing hygienic laws on entire peoples in the name of divine revelation, but these instances are quoted to illustrate one of the agencies which have favored in historic times the emigrations which have taken place from temperate, and even cold countries, towards the tropics.

But is it not clear that in adopting traditions lived-up-to and proven by the results which we have mentioned we have not simple theories but a truly tested rule? The difficulty is to get it adopted by Europeans who in their turn are now invading tropical climates."

"Civilized man in our day is certainly more refractory than was the barbarian, to all restrictions placed upon his pleasures and tastes. Especially in the matter of diet he is so much the slave of national customs that it costs him much to break away from them."

The diet of the average American at home contains 125 grams of proteid whereas only 40 to 50 grams are necessary (with abundance of carbohydrates) to preserve the nitrogen equilibrium and prevent tissue waste. It seems that such a proteid excess (luxus consumptio) is less desirable and less harmless in the tropics. That this is true is shown by the fact that in India and other European tropical colonies, as soon as the wealthier natives begin to adopt European modes of life, they at once lose their relative immunity to dysentery, liver abscess, jaundice and like intestinal disorders which are the scourges of the European immigrant. It is a matter of common experience that in hot weather a diminished desire for meat on the part of most people is observed and especially the kinds of meat chiefly eaten by the American soldier—roast (baked) beef with rich gravy and bacon. At the same time comes a longing for fresh vegetables and fruits.

The appetite is lessened by long continued heat and is more capricious. It craves *variety,* especially in vegetables and fruits, and a restricted and monotonous diet becomes distasteful and repulsive. Under these circumstances strength once lost is regained slowly, if at all, and convalescents do not entirely recover without a change of scene, which means, among other things, a change of diet. The importance of variety in the ration, and especially in the vegetable component is, in the tropics, I believe, a matter, the great importance of which has been overlooked.

On one point, and only one, I believe in the whole subject of tropical dietetics are, all observers agreed, and that is as to the disastrous effects of alcoholic excess in the tropics, though, as regards what constitutes excess there is not quite as much unanimity. Now alcohol is the instinctive resort of the bored mind, and the dulled appetite, the refuge from monotony of occupation and monotony of food.

The responsibility for much of the drunkenness in the Army must be divided between the commanding officer who does not vary his drills and exercises, and the captain who puts every

day before his men the never varying dinner of roast beef and potatoes.

The need of ice in the tropics both to preserve the perishable constituents of the ration, and to furnish the cold drink which has from habit become indispensable to the American palate, is an obvious necessity, and it is equally clear that it should be furnished by the Commissary Department as a part of the ration.

The cost in the tropics varies widely, and is often excessive, and it is not just or wise to saddle it upon the company fund, which will in isolated localities, where ice is most expensive, be most heavily taxed to provide the necessary variety in diet.

It may be argued that as far as ice-water is concerned this is an acquired taste and one which can be unlearned, and which is, from a hygienic standpoint, not desirable. Practically I do not concur in this view. Americans all have the ice-water habit and, if the soldier is compelled to drink tepid water, his thirst is not satisfied except with enormous quantities which upset the stomach and produce excessive sweating and loss of strength.

There is also value in the fact that where the company is tied down to one source of supply the company ice-water barrel or cooler, the purity of the supply is more easily safeguarded by the captain than if there is no such supply and the soldier drinks wherever he finds water. In the absence of the ice-water barrel the relative coolness of the surface-well is irresistible.

To sum up, the requirements of a tropical dietary, as compared with one suited to a colder climate, are:

(1) Less fats and more carbohydrates.

(2) Less stimulating proteid in the form of meat.

(3) Greater *variety* of diet, both of meats and of carbohydrates in the form of fresh vegetables and fruits.

(4) A fairly liberal supply of ice.

These we will, for convenience, refer to as requirements (1), (2), (3) and (4).

II. Changes in the present ration to provide for the above differences.

The ration as at present constituted is given in Table I. side by side with the proposed Tropical Ration.

For a proper study of the ration it seemed essential to find out as far as possible what the soldier in the tropics actually eats, and the Tables II. and III. appended, give the results of this inquiry at Columbia Barracks, Cuba, with a garrison of about 1,900 men, and embracing the period from July 1 to December 31, 1899.

We will now take up the components under the headings given in the table and see how far they meet our requirements.

MEAT COMPONENTS.

Requirement 1: Excess of fats.

The uninitiated in reading over the ration table in A. R. 1,253, would say at once that no excess of fats is *mandatory* therein. But existing orders require the issue of salt meat (which means in practice bacon and pork) three days in ten. This is undoubtedly excessive for the tropics.

Par. II. of G. O. 65 of 1898, would seem to put it in the hand of Post Commanders to correct this, but practically they do not do it. There seems to be a curious uncertainty in the army as to who shall decide whether the soldier shall get one or another of the alternative issues offered him in the ration table.

There are thus many alternatives in the meat components given in A. R. 1,253, but the choice of them does not seem to lie with the soldier or his captain.

An examination of the articles in Table II. which compose the great bulk of the soldiers' fare will show that there is much truth in the remark made by a medical officer in a recent article on the ration* that "the variety stated on paper is very delusive."

Of 185 consecutive days at Columbia Barracks, Cuba, beef was issued 124 days and bacon 47 days. The variety is, in truth, much like that at the boarding school where there was always a choice of four meats "Ram, lamb, sheep or mutton," only in the Army it is never mutton. Bacon is issued three days in every ten and the company commander cannot take anything else in its place. He must use it, or sell it, and in the latter case can sell it only to the commissary,* which will give him for it only $7\frac{5}{8}$ cents a pound, less than one-third of the value of the beef ration. If he sells it, there is a loss to the company fund as compared with the value of the fresh beef ration, of $103.23 a month—the strength of the company being 100 men. This is more than the average amount of the monthly savings per company.

There is thus a pecuniary compulsion to eat the bacon, which would not be suspected in the most careful perusal of the regulations concerning the ration. And practically it *is* eaten as is shown in Table II., only 19 per cent. of it being sold.

It would seem then that to meet requirement (1) there

* The U. S. and foreign rations compared—Chas. E. Woodruff, Medical Department, U. S. A., in Medical Record, May 20, 1899.

† G. O. 16, Division of Cuba, 1899.

should not be compulsory issues of bacon or (salt) pork except for field service. This low commutation value of bacon and pork will insure their not being too often drawn.

The restriction of the use of bacon and pork refers of course to normal garrison life and the garrison issues. In the field they are indispensable. A certain amount of fat is needed also for frying and other cooking purposes, but this can be purchased in the form of either bacon, pork or lard, from the commissary out of the savings of the beef ration.

It is recognized that bacon on account of its keeping qualities, the ease with which it is cooked, and its high value in calorics is a valuable if not indispensable emergency ration, and that a certain amount must be kept on hand in commissaries to meet the exigencies of field service. Nor will bacon keep indefinitely, and this supply must be, from time to time, renewed. But in these days of telegraphs and fast steamers this supply need not be large, and A. R. 1,236 seems to provide a remedy against loss from deterioration, preferable from a hygienic standpoint to forcing it down the throats of soldiers.

Requirement 2 will be met to a large extent by permitting company commanders to make a liberal saving of fresh beef. The restrictions which now surround this privilege rob it of much of its value, the savings being limited to one days issue in ten, and not being paid in cash, but taken out in trade as it were. The price of fresh beef is so high that the temptation to make savings of it would, if these restrictions were removed, insure to a considerable extent against an excessive consumption. But to guard against the well known conservatism of the company cook it would be better to issue only the English allowance of twelve ounces of fresh meat, the balance being commuted in cash.

Fresh fish are abundant and cheap in almost all parts of our new tropical possessions and it is somewhat surprising that the recent authority for the issue of this cheap, excellent and wholesome variation of the meat ration is not more taken advantage of.

I am informed that the men eat it gladly when issued. Conservatism which is so characteristic of the military service and, in matters of food, of the Anglo-Saxon race, together with slight administrative difficulties which, with practice would disappear, seem to be the causes of its comparatively limited use at Columbia Barracks. It has, however, been more regularly used at other posts in this department.

Routine is dear alike to the Commissary Sergeant and company cook, and these two important persons have more influ-

ence than is generally recognized in deciding what shall go into the company kitchen. When the greater trouble and labor to the latter in preparing and cooking fish is considered, as well as the fact that the fish ration is less than that of meat, the absence of fish from the bill of fare, where its use is optional with company authorities, is largely explained. Being a less satisfying food than beef, and the waste, heads, tails, entrails, etc., being greater than the proportion of bone in beef—being sometimes as much as 35 per cent., no reason is known why the ration should be less than that of beef, viz.: twenty ounces.

Fish is largely eaten by all tropical races near the sources of supply and is undoubtedly less stimulating and more easily digested than butchers' meats. For this cause, and to secure variety, fresh fish, where obtainable, should be issued twice a week, no savings being permitted.

Mutton is authorized in place of beef where the cost does not exceed that of the latter, but in the ration as issued, this provision seems to be a dead letter. The writer has not in fifteen years of service known of its issue that number of times, and the contract for Cuba does not, I am informed, make mention of it. In the rare instances when issued it has been at the request of the contractor and for his own convenience.

There is an impression among army cooks that mutton contains more bone and less meat to the ration than beef and so does not go so far. If this were true we could well afford in the tropics to sacrifice some little from our luxus consumption of meat to gain in variety. Mutton being a drier meat than beef stands refrigerating even better and improves, as is well known, by refrigeration. For the sake of variety the Commissary Department should issue it at least one day in ten, or better once a week as in the English service, and the limitation as to relative cost should be removed.

The issue of the meat components at Columbia Barracks, Cuba, for 185 consecutive days has been as follows:

Fresh beef	124 days
Mutton	none.
Bacon	47 days
Fresh fish	1 day
Other issues	13 days

which shows well the monotony of the issue, the only important variant being the undesirable bacon.

A certainly more desirable issue, and one apparently permissible according to the paper ration, would have been, for example, somewhat as follows:

Fresh beef	100 days
Fresh mutton	37 days
Fresh fish	38 days
Other issues	10 days

a saving of two-fifths of the fresh meat being authorized.

As fresh fish is quite cheap at Havana, the difference in cost would have been immaterial.

Vegetable Components.

The same failure to provide the greatest variety possible under the regulations which we observed in the meat component is found in a far greater degree when we come to the fresh vegetable supply.

Potatoes and onions are the only fresh vegetables habitually issued to the soldier, and the provision of "four four-fifths ounces of other fresh vegetables, not canned, when they can be obtained in the vicinity of the post or transported in a wholesome condition from a distance," in which one catches the promise of occasional cabbages and beets, turnips and sweet potatoes, squashes and string beans, corn and fresh tomatoes, this provision is practically a dead letter. Of course it is not to be expected that a variety of vegetables can be furnished the soldier in the field; there, if he gets potatoes and onions he is lucky. But in garrison, with abundant markets near at hand, it *is* practicable for the post or regimental commissary to make his purchases of fresh vegetables in large variety, and it is not necessary or right that the vegetable issue should be limited to an eternal round of potatoes and onions. It should not be left to the company fund to provide this variety. An examination of Table III. shows that the company fund is entirely inadequate.

The income from the savings is there shown to be only one and eight-tenths cents a day per capita, and of this not quite one-half is spent for fresh vegetables.

If the Subsistence Department will not furnish this variety the company fund should be increased by authorizing a liberal meat saving and perhaps also by a money commutation for this purpose.

But if in the United States it is to be regretted that the issue of fresh vegetables is in practice limited to potatoes and onions; in the tropics where for seven months in each year a really good potato cannot be had, it is simply folly.

The most important members of the vegetable ration as, aside from the bread, furnishing the main supply of carbohydrates, are rice and potatoes.

In the ration rice is an occasional and commutable issue,

taking its turn with beans and peas, while the potato is a daily issue furnishing the great bulk of the fresh vegetable allowance.

The writer has since 1892 been continuously stationed (with the exception of one year) in Florida and Cuba, and the conviction has constantly grown upon him that for hot climates these two should in relative importance be reversed.

In our own country in traveling south, as soon as one reaches the Cotton States, he finds that the potato, which in New England and the northwest dominates the table at every meal, has retired to the secondary and humble position of an occasional visitor at dinner, while rice, which was in the North an occasional and glutinous mess, is perfectly cooked and always in evidence.

Advancing still further south we find when we reach the tropics that rice becomes the mainstay in the support of whole populations while the potato has retired into relative insignificance—taking a stand well to the rear of the sweet potato, yam and banana.

The reasons are not far to seek. The home of the potato is in relatively high latitudes and altitudes, and though it will grow in the tropics, it is there an unhealthy exotic which will not keep, nor will potatoes brought from the United States keep in the Antilles during the spring and summer, the three weeks or more necessary to get them from the hands of the dealer in New York into the hands of the company cook in Cuba.

In the Philippines this difficulty is of course vastly increased.

At Key West so heavy was the loss of potatoes shipped from New York by water during the seven months between March 1st and October 1st, and so constant the complaints, that the Commissary Department at length, at the request, I believe, of the contractor, had the potatoes inspected at the dock in New York. These potatoes would spoil so rapidly in the hot hold of the vessel that though excellent when inspected, when issued to troops at Key West a ten days' issue would frequently yield only enough for two or three meals.

The loss of starch from these changes will be in those which are not rotten very considerable, a loss which can be but ill afforded by a vegetable, which at best contains only 21 per cent. of starch. Of course the anti-scorbutic value of the vegetable salts, chiefly citrates, in the potato has more than any other quality given it its unique value among the carbohydrate producers of the temperate zone, but this is of small importance in the home of the citrus fruits, and where we have in the sweet potato and banana anti-scorbutics of equal value.

As a food, rice contains four times as much proteid and

four times as much starch as potato. To get the 600 grams of carbohydrates which are needed with a reduced fat allowance, from potatoes alone it would be necessary to consume 6.25 pounds, costing 16.35 cents, while with rice it would be supplied by 1.73 pounds, costing 7.04 cents. Yet such is the conservatism of the American soldier, and such the obstinacy of the company cook, that we find companies selling part of their rice, and buying more potatoes to make up the loss from decay.

It is to be borne in mind, however, that rice is a dry vegetable, and although the allowance of it should be increased in the tropics, it should not be at the expense of the pound of fresh vegetable. That should be issued in full and in vegetables which are really fresh and good, and in all possible variety.

Fresh vegetables can be had in all tropical countries and it is a mistake to attempt to supply them from a distance of from 1,000 to 8,000 miles. Instead of being limited to potatoes, therefore, the fresh vegetable components should be of fresh vegetables in all possible variety.

The following is a list of the common vegetables, several of which can be obtained in abundance in Cuba at almost any season of the year, while during the winter most of them are abundant and with proper care to get competitive prices reasonably cheap:

Sweet potato.
White potato (in winter).
Cabbage.
Onions.
Kershaw (pumpkin-squash).
Beets.
Turnips.
Yams.
Plantains.
Bananas.

The value of the native sweet potato as a substitute in the tropics for the exotic white potato has been so far curiously overlooked. It is always to be had and is always good.

The vegetable components of the tropical ration should then be:

Dried vegetables,		
Rice	2 2-5	oz.
Frijoles	2 2-5	oz.
or Macaroni	2	oz.
Fresh vegetables in proper variety	16	oz.

(Purchased if practicable in the vicinity of the post or command.)

Rice, it should be observed, is a daily, not an alternative issue.

Dried fruits are a recent and most valuable addition to the ration. In the field, when fresh vegetables cannot be supplied, canned tomatoes and other canned vegetables may be issued in lieu of them, or a money commutation of five cents may be paid in lieu of the fresh vegetable component, so as to permit of company or individual purchases. The commanding officer should be authorized in the field to increase the dried fruit component to three ounces when deemed necessary.

The changes proposed are not radical or expensive, yet they will make the dietary conform alike to the rules of physiology and experience, and they cannot but have a vast influence for good on the health of the soldier.

The great perils of the tropics, aside from infectious diseases, come from disorders of the digestive apparatus, and even the infectious diseases cannot be wholly excluded, as it is well known that intestinal disorders quickly break down the resistant force of the organism and render it an easy prey to infections.

Diseases of the digestive organs constituted at Columbia Barracks 44 per cent. of all admissions for diseases during the last six months of the past year.

If the various infections, malarial, typhoid, etc., which find in the subject of gastro-intestinal disease conditions favorable to invasion of the system, could be added to these, the sum would be, I believe, a surprisingly large proportion of all cases of disease.

If, in the tropics, alimentation is in truth the foundation of the temple of Hygiene, and if the health and efficiency of an army will depend upon its ration, it is clear that the Sanitary Corps must have a voice in the selection of that ration, and considerations of convenience of supply and relative cost, which have so far been of controlling importance, must be weighed against hygienic considerations with which our efficient Subsistence Department is of course unfamiliar.

Hence the necessity for a mixed jury and a scientific and unbiased verdict.

TABLE I.

PRESENT RATION. Articles.	Quantities per ration, ounces or gills.	PROPOSED TROPICAL RATION. Articles.	Quantities per ration, ounces.	Savings authorized, ounces.
Meat Components—		*Meat Components—*		
Fresh beef	20	Fresh beef.	20	8
or fresh mutton when the cost does not exceed that of beef	20	or fresh mutton	20	8
		or fresh fish	20*	None
or pork	12	or when these cannot be furnished:		
or bacon	12			
or salt beef	22	Bacon	12	12
or dried fish, when desired	14	or salt beef	12	12
or pickled fish	18	or dried fish	14	14
or fresh fish	18	or pickled fish	18	18
		or canned salmon	16	16
		(Mutton and fish to be issued, each, twice in ten days.)		
Bread Components—		*Bread Components—*		
Flour	18	Same as present ration.		
or soft bread	18			
or hard bread	16			
or corn meal	20			
Baking powder for troops in the field, when necessary to bake their own bread.				
Vegetable Components—		*Vegetable Components—*		
Beans	$2\frac{2}{5}$	Rice	$2\frac{2}{5}$	None
or peas	$2\frac{2}{5}$	Frijoles	$2\frac{2}{5}$	None
or rice	$1\frac{3}{5}$	or macaroni	2	None
or hominy	$1\frac{3}{5}$	Fresh vegetables in proper variety (purchased in the vicinity of the post when practicable)	16	None
Potatoes	16			
or potatoes, $12\frac{4}{5}$ ounces, and onions, $3\frac{1}{5}$ ounces	16	Ice	32	None
or potatoes $11\frac{1}{5}$ ounces, and canned tomatoes, $4\frac{4}{5}$ ounces, or $4\frac{4}{5}$ ounces of other fresh vegetables not canned, when they can be obtained in the vicinity of the post or transported in a wholesome condition from a distance	16			
Dried fruit	2			
Coffee and Sugar Components—		*Coffee and Sugar Components—*		
Coffee, green	$1\frac{3}{5}$	Same as present ration.		
or coffee roasted	$1\frac{7}{25}$			
or tea, green or black	$\frac{8}{25}$			
Sugar	$2\frac{2}{5}$			
or molasses	$\frac{16}{25}$			
or cane syrup	$\frac{16}{25}$			
Seasoning Components—		*Seasoning Components—*		
Vinegar	$\frac{8}{25}$	Same as present ration.		
Salt	$\frac{16}{25}$			
Pepper, black	$\frac{1}{25}$			
Soap and Candle Components—		*Soap and Candle Components—*		
Soap	$\frac{16}{25}$	Same as present ration.		
Candles (when illuminating oil is not furnished by the Quartermaster's Department)	$\frac{6}{25}$			

* The issue of fresh meat in the garrison will ordinarily be 12 ounces, the commutation of the remaining 8 ounces being paid in cash into the company, troop, hospital, or other mess fund.

Commanders of Departments, Corps, or independent divisions, or

TABLE II.

Savings made by 18 organizations at Columbia Barracks, Cuba, July 1 to December 31, 1899.

SUBSISTANCE STORES.

	Lbs. issued,	Lbs. saved.	Price per cwt.	Amount of Savings.
Fresh beef	282,435	13,943	13.24	$1,846.05
Mackerel	7,298	-----	6.4	
Ham	1,690	-----	13.	
Bacon	71,550	13,640	7 5/8	1,040.05
Salmon (canned)	2,579	-----		
Corned beef (canned)	6,091	-----	13.75	
Fresh fish	2,579	-----		
Flour	398,595	94,562	2.08	1,966.89
Corn meal	------	-----	1.24	
Beans	26,238	1,475	3.23	47.64
Peas	1,057	-----	2.37	
Rice	17,256	2,967	3.77	111.86
Hominy	------	-----	2.	
Potatoes	199,660	-----	3.61	
Onions	39,763	-----	2.91	
Canned tomatoes	43,175	-----	2.17	
Coffee	35,430	9,220	12.	1,106.40
Sugar	53,146	524	3.90	20.44
Dried fruit	44,879	-----		
				$6,139.33

Average strength of garrison, 1,900 men.

It will be observed that the savings per capita per diem amounts to only 1.8 cents, including the savings of fresh beef which cannot be expended outside of the commissary.

brigades, are authorized, upon recommendation of the Chief Surgeon, to increase the issue of fresh meat, not to exceed 20 ounces, when necessary. Savings of fresh fish are not authorized.

In the field canned tomatoes, or other canned or dried vegetables may be issued in lieu of fresh vegetables to make up the deficiences of supply of the latter. If desired by company commanders a commutation price of five cents shall be paid in lieu of the allowance of fresh vegetables when these cannot be supplied by the Commissary Department in the field.

When in the opinion of the Chief Commissary of the Department, or command, it is impracticable to supply ice, a commutation of one cent a pound shall be paid in lieu thereof.

NOTE.—The commutation price for fresh vegetables in the field is intentionally made about double the value of the vegetable component, because of the difficulty of making purchases cheaply and to the best advantage under the condition of field service.

Table III.

Amounts of fresh vegetables purchased from company funds of 18 organizations at Columbia Barracks, Cuba, during the period from July 1 to December, 1899:

Cabbage	3,464 heads
Sauerkraut	22 barrels
Potatoes	225 barrels
Sweet potatoes	34 barrels
Turnips	15 barrels
Beets	11 barrels

Other fresh vegetables, string beans, pumpkins, lettuce, radishes, squash, fruits, etc., to the value of $522.75.

The total expenditure was approximately $2,800, or $\frac{4}{5}$ of a cent per capita, per diem.

In addition canned vegetables in considerable amounts were purchased from the commissary.

XXV. THE IDEAL RATION FOR AN ARMY IN THE TROPICS.*

BY

CAPTAIN EDWARD L. MUNSON,

ASSISTANT SURGEON U. S. ARMY.

Since the amount and character of food required for the preservation of health and vigor is influenced not only by climate but also, to a certain degree, by body weight, age, race, custom of living and other varying factors, it will be premised at the outset that the army above referred to is composed only of white troops, preferably drawn from the same regions and recruited under the same physical requirements as are the military forces of the United States. It is further assumed that the present United States Army ration, as established by law, will form the most satisfactory basis for the supply of food to troops of the above character, under any conditions of climate, since it contains only such nutrient articles as are commonly included in the diet of the civil class from which the American soldier is ordinarily drawn and to the ready assimilation of which his system is accustomed through the influence of heredity as well as personal habit. There are then two questions to be answered: Is the present army ration, considered as a whole, adapted to the needs of the United States soldier serving in the tropics? And if not, why not? These points having been determined, the remedy for existing defects can readily be deduced.

To the first question common experience returns an unqualified negative, best embodied in the words of the Court of Inquiry appointed to investigate the character of the food issued to troops during the war with Spain. This court reported as follows: "As to the effects of the food supply, having regard to sufficiency and quality, it seems to be clearly established that the army ration as supplied, without modification, to the troops serving in the West Indies, was by no means well adapted for use in a tropical climate. If this be true the unfitness of the

* This essay was unanimously awarded the prize of $100.00 offered by Major Louis L. Seaman, late Surgeon 1st U. S. Volunteer Engineers, through the Military Service Institution of the United States, for the best discussion of the subject. The board of award was composed of Col. John W. Weston, Acting Commissary General of Subsistance, U. S. Army; Lieut. Col. Charles Smart, Deputy Surgeon General, U. S. Army, and Lieut. Col. Wm. Dougherty, 7th U. S. Infantry.

ration should have manifested itself by its failure to keep the troops, who subsisted upon it, in the best possible condition for service in hot climates. This, in the opinion of the court, is fully established in evidence."

The formulation of a reply to the second question involves, as a fundamental principle, a brief consideration of the physiology of hot climates—the determination of such alterations of body-function as may result from the climatic and environmental conditions obtaining in the tropics. It implies, also, the appreciation and comparison of the dietaries ordinarily used, under varying conditions of climate, by human beings of the military class in civil life; a general review of all facts based upon practical experience with the phenomena of nutrition, especially in low latitudes; and finally, a study of the existing army ration with reference to its modification for the tropics according to such principles as may appear to have been fairly established.

I. THE PHYSIOLOGY OF HOT CLIMATES.

The body temperature, in the tropics, is appreciably elevated above the normal in new arrivals. Rattray[1] in his investigations upon this point, obtained the following results:

Hour of day.	Temperate climate, near England. Temp. 65° F. Average of 10 days.	Tropics generally. Average of 51 days.	Equator, Temp. 84° F. Average of 7 days.
9 A. M.	98.1	98.51	98.5
3 P. M.	98.3	99.00	99.5
9 P. M.	98.5	98.47	99.1
Average ...	98.3	98.66	99.02

Maurel[2] found an increase of body heat, in individuals recently arrived in the West Indies, ranging from 0.5° to 0.9° F.; and Jousset[3] noted an average increase, among the whites in Senegal, of even greater degree. Fayrer[4] states that among European residents in Bengal the bodily temperature is 0.41° F. higher than the average of healthy persons in England. Internal heat, in temperate climates, is readily lost by radiation and contact with the external air, by the heating of inspired air, by exhalation of moisture in the breath and by cutaneous evaporation. In the tropics, the difference between internal and external temperature is always very slight and it may frequently happen that, for considerable periods, the heat of the surrounding atmosphere may even exceed that of the body. Further, the high degree

of humidity ordinarily present in the tropics opposes evaporation of moisture. It therefore happens, through these changed conditions, that, instead of dissipating heat, the vital forces must frequently neutralize heat-reception in order to keep the bodily temperature down to normal. This produces an alteration in metabolism and throws additional work on the kidneys and liver; for an excess of nutritive material, which in temperate climates would be oxidized in the production of heat, requires here to be merely excreted.

A loss of body weight occurs in hot countries and the same is commonly observed in summer in the temperate zone. Rattray[5] noted that with an average temperature of 80° F. the loss of weight among a body of marines averaged eleven pounds per man during the period of one year. The decrease was greater when salt provisions were given and the air loaded with moisture; the loss of weight under hard labor being greater and more rapid. In the dry season 44 per cent., and in the wet season 76 per cent. of the individuals observed lost in weight. Rattray concluded that this effect was due to the destructive influence of prolonged heat upon the cellular elements of the organism, together with imperfect oxygenation. Adipose tissue, as a non-conductor, is undoubtedly potent in conserving internal heat and diminishing the effect of outside low temperature. In cold regions the proportion of fat in the organism is much greater than in warm climates, where the storing up of fats in human tissue is rare and even the artificial fattening of animals is accomplished with the greatest difficulty. In cold climates, on the contrary, considerable deposition of fatty material is the rule. The animal flesh of the far north, as seal, bear and walrus meat, is notoriously rich in fats; while the chief protection of the whale against the cold of the polar seas is the thick layer of blubber in which the muscular structure is enveloped. Viewed from this standpoint, the decrease of body-fat which occurs in the tropics may be looked upon as one of the most important processes by which the adaptation of the organism to changed conditions of temperature is accomplished. The discomfort of the obese during warm weather is proverbial, and hence loss of weight, provided the decrease is strictly limited to the adipose tissue alone, may be considered as wholly beneficial. It is obvious that any excess of foods, which, in temperate climates is largely converted into systemic fat, cannot be devoted to this purpose in the tropics with either facility or advantage.

Tropical heat directly lowers the pulse rate; Rattray[1] finding that the average rate of cardiac action in the tropics was less

by 2½ beats per minute than in the temperate zone. The following results were obtained by him:

Hour.	Number of Observations.	TROPICS.				Temperate Zone average.
		Lowest.	Highest.	Range.	Average.	
9 A. M.	53	66	112	46	86.4	91.7
3 P. M.	53	68	108	42	88.8	88.1
9 P. M.	49	73	110	37	87.3	90.5
Average	--	--	--	--	87.5	90.1

This reduction of the pulse rate is doubtless related to the diminished respiratory function; and further observation proves what the latter fact suggests, viz: that in the tropics the pulse is diminished not only in frequency but in force. The low arterial tension always noted in hot climates is a direct result of loss of fluid through increased perspiration favored by a relaxed state of the capillaries.

The first effect of tropical heat is to increase the respiratory capacity. This has been shown by Rattray[1] by means of the spirometer; his observations being subsequently confirmed by others. The results obtained by the investigator are as follows:

	Temp. Zone, near England, at sea; June. Therm. 65° F., Hygr. 2½° F.	Tropics, at sea; July. Therm. 78° F. Hygr. 4° F.	Tropics, at sea; Aug. Therm. 83° F. Hygr. 4° F.	Temp. Zone, near England, at sea; Sept. Therm. 65° F. Hygr. 1½° F.	Temp. Zone, England; Feb. Therm. 42° F. Hygr. 3° F.
Average capacity of chest in cubic inches	256.083	280.75	287.416	260.25	253.727

The average gain in lung capacity noted by him for the tropics was 31.4163 cubic inches; the percentage of gain, as compared with the temperate zone, amounting to 12.24 per cent. Cullimore,[6] however, states that this increase in vital capacity does not continue, and that, after a period ranging from six months to two years, it falls below the level for Europe.

Closely allied to the foregoing is the influence of tropical climate on the frequency of respiration. In heated air-chambers, the rate of respiration becomes less in man, and Vierordt and Ludwig[7] long since found that the same results were obtained

in animals subjected to great heat. Rattray's[1] observations as to the comparative frequency of respirations in hot and cool climates are as follows:

		Average Temperature. (Shade.) Fahr.	Highest Number of Respirations.	Lowest Number of Respirations.	Average Number of Respirations.
Temperate Zone.	England in Summer. (June.)	62°	18	13.5	15.68
	England in Winter. (Feb.)	42.25°	17.5	15	16.50
Tropics.	Equatorial doldrums, outward voyage.	78.74°	14.5	11	12.74
	Equatorial doldrums, return voyage.	78.6°	15	12	13.74

Not only is the respiratory action markedly decreased in hot climates, but the greater quantity of air inspired in the tropics does not make up for the diminished number of respirations in supplying the same amount of oxygen to the blood as in cold climates. Using the above data, Rattray[1] calculated the deficiency in the oxygen inspired in the tropics as follows:

Climate.	Cubic inches in each Inspiration.	Number of Inspirations per Minute.	Cubic inches Respired.
England	15	17	255
Tropics	16.836	14	235.704

Difference in favor of a temperate climate, 19,296 cubic inches, or 7.567 per cent.

"This decrease of 7.567 per cent. in the quantity of air respired daily, diminishes the quantity of carbon which the lungs in ordinary circumstances can throw off in the tropics by 0.7567 ounces; 10 ounces being taken as the average amount thrown off in temperate climates, will give 9.243 ounces as the amount for the tropics. But as tropical air contains less oxygen for

a given bulk than air of colder latitudes, through the expansion of gases by heat, the decarbonizing capabilities of the lungs in tropical latitudes will evidently be still further curtailed and the amount of carbon they can throw off considerably decreased. Air increases by 1.480 its volume for every degree of heat, and the difference between the temperatures in which these experiments were carried on being 18 degrees F. (65° and 83°F.), if we reduce the amount inspired in the tropics by a 18.480 part, this will give its equivalent bulk in the temperate zone, thus:

$$\frac{235.704}{1+1/480\times 18}=\frac{235.704}{1.0375}=227.1846 \text{ cubic inches.}$$

which is equal to a decrease of 8.5194 cubic inches or 3.614 per cent. Then 255 minus 227.1846 cubic inches gives 27.8154 cubic inches per minute, or 1668.924 cubic inches per hour, or 40054.176 cubic inches per day=10.907 per cent. as the grand total difference in favor of a temperate climate, after deducting the real increase in volume and correcting for expansion by heat. By again reducing the 9.243 oz. of carbon by 3.614 per cent., or 0.33409 oz., we get 8.909 oz. as the total amount which the lungs throw off in the tropics, the difference between the tropical and extra-tropical qualities being 1.1028 oz."

The explanation of the variation in respiratory capacity, noted above, would appear to be due to the fact that there is no actual increase, for the tropics, in the size of the chest and enclosed lungs, but only an alteration in the relative proportion of blood and air contained in the latter. The bulk of the lungs remaining the same in the tropics as in colder latitudes; or being, as shown by Parkes,[*] even somewhat diminished from their comparative abeyance as excreting and heat-generating organs, the blood, diverted to the functionally excited and congested skin and liver, permits the ingress of a larger quantity of air into the pulmonary air cells.

With the diminution in arterial tension there is, also, at each respiratory movement, less blood forced through the lungs than in the temperate climate, and this diminution necessarily implies a lessened value to the respiratory act. Further, the air in the tropics is rarified, and pressure, which rules the conditions of pulmonary endosmosis, is diminished; hence it may be that the air reaches the pulmonary alveoles under pressure insufficient properly to force it into the pulmonary capillaries. The deficiency of oxygen taken into the organism in the tropics, as influenced by the above factors, may therefore be considered to be made up as follows:

Lessened value of respiratory act	7.5	per cent.
Rarefaction of air	3.6	" "
Diminished cardiac action	3.0	" "
Deficient air pressure	2.2	" "
Total	16.3	" "

It is undoubtedly true that less oxygen is required in the high temperatures of the tropics. Through decreased exertion a smaller amount is required for the metamorphosis of waste particles; and, where lessened necessity and desire for food diminish the ingesta, less is required for direct combination with the nutritive elements in the production of energy. It is probable, however, that there is a somewhat increased absorption of oxygen in hot climates by the functionally excited skin, which may, to a slight degree, act vicariously as a respiratory organ and so lessen the amount required by the lungs. Furthermore, the skin is aided in relieving the lungs in the decarbonizing process by the functionally excited liver and kidneys, which eliminate carbon in forms not requiring much oxygen for their formation, viz., as bile and uric acid.

The amount of sweat is greatly increased. Fonssagrives[9] states that it is double the average amount secreted in Europe, often amounting to four or five pounds in the twenty-four hours. The amount of solids eliminated, however, is not proportionately increased. In addition, the secretion of sebum is more abundant than in temperate climates. In this connection Hill[10] says: "The skin of the negro is a much more active organ of depuration than that of the white. It not merely exhales a larger proportion of aqueous fluid and carbonic acid from the blood, but it also elaborates a more unctuous secretion, which, by its abundance and sensible properties, evidently possesses a considerable influence in counteracting the heating effects of the sun's rays upon the body and in carrying off superabundant caloric."

As a result of increased perspiration there is a diminished excretion of urine; the reduction amounting to about one-third of the usual amount. Mourson[11] states that the diminution in the output of urea usually amounts to about 10 or 15 per cent. According to Eijkman,[12] Europeans who had been in Java from two to six months excreted 14.8 grams of nitrogen daily, or 0.226 grams per kilogram of body weight, while those who had lived in the tropics one and a half to fifteen years excreted 12.802 grams of nitrogen daily; or 0.193 grams per kilogram of body weight. Such decrease in eliminatory function on the

part of the kidneys, according to Moore,[13] is followed by increased secretory action of the liver, whereby some effete matter is passed into the intestines with the bile. But increased liver action is accompanied by congestion; and congestion frequently by hepatic deposit and degeneration, with impairment of function.

Through the loss of fluid resulting from increased perspiration, there is a diminution in the secretion of saliva, mucus, gastric and pancreatic juices and bile. As a consequence, also, there is dryness of the throat and fauces and exaggeration of thirst, weakness of appetite, impaired digestion, gastric fullness after eating and habitual constipation; these, according to Nielly,[14] being the digestive phenomena constantly observed in the tropics.

II. STANDARDS OF DIET.

Various attempts have been made by physiologists and chemists to devise standards representing the amounts of nutrients required, under varying conditions, for daily sustenance. There are, however, two great difficulties in the way of setting up such standards. The first is that there is not sufficient definite knowledge on the subject of nutrition to permit of an exact statement as to how much the average man, doing a certain class of work, requires for the maintenance of his body in vigorous condition and for the creation of energy expended in the form of heat and work. The second difficulty is due to the fact that different individuals of the same class differ widely in their demands for food and the use they make of it. One will eat more and the other less, while both do the same amount of work; or both will eat the same food and do the same amount of work, yet one will be fat and the other lean; or both have the same diet, and yet one will be strong and capable of performing considerable work while the other will be weak and able to accomplish little. Exactly why individuals differ in their ways of utilizing their food, and how to measure these differences and make rules exactly to fit them, are problems which are as yet far from solution. The nutrition of man is by no means a mere question of grams of protein and units of energy, and hence the subject of dietetics can never be reduced to an exact science. The best that can be done is to make general estimates with the understanding that such estimates are only approximately correct, even for a special class. These are reached by observing the amount and relative proportion in the food actually consumed by the individuals composing the

class in question; and also by experiments in which the income and outgo of the body are directly compared. But little investigation has as yet been done by the latter method, and present knowledge of nutrition may be considered to be based entirely upon observation and analysis of established dietaries. For laboring men performing moderate muscular work, the standards for daily diet, according to Atwater,[15] have been variously fixed as follows:

Author.	Nutrients in Daily Food.				
	Protein gms.	Fats gms.	Carbohydrates gms.	Fuel value, Calories.	Nutrient ratio.
Playfair-England	117.78	49.83	530.01	3,140	1:5.4
Moleschott-Italy	131.37	40.77	548.13	3,160	1:4.9
Wolff-Germany	126.84	36.24	538.07	3,030	1:4.7
Voit-Germany	117.78	54.36	498.30	3,055	1:5.2
Atwater-United States	126.84	77.61 to 149.49	398.64 to 548.13	3,500	1:7

In determining the diet of the soldier, however, the above standards do not apply, since they are sufficient only for moderate labor and are not capable of furnishing the requisite energy for the muscular work of high degree which troops, from the nature of their service, may at any time be called upon to perform. For the requisite data in this respect it is necessary to refer to the dietaries of men at hard labor; the following table being intentionally made to include dietaries of this character for various countries in the northern portion of the temperate zone, since the United States army is heterogeneous in its composition and the foreign-born element—largely derived from the countries named—undoubtedly brings with it into the service the dietetic preferences resulting from previous habit.

TYPICAL HARD LABOR DIETARIES FOR THE NORTHERN PORTION OF THE TEMPERATE ZONE.

	Protein, gms.	Fats, gms.	Carbo-hydrates, gms.	Fuel Value, Calories.	Nitrogen, gms.	Nutritive Ratio (Protein to Energy.)
England.						
Royal Engineers, active work (Playfair)[16]	144	83	631	3,950	23.04	1:5.7
Sweden.						
Mechanics (Hultgren and Landergren)[17]	189	110	714	4,725	30.24	1:5.1
Russia.						
Factory operatives, near Moscow (Erismann)[18]	132	80	584	3,680	21.11	1:5.8
Germany.						
Machinists, Krupp Gun Works (Prausnitz)[19]	139	113	677	4,395	22.24	1:6.7
Southern Austria.						
Farm laborers, at harvesting (Ohlmüller)[20]	159	62	977	5,235	25.44	1:7
United States.						
Mechanics, Massachusetts and Connecticut (Atwater)[21]	154	227	626	5,275	24.64	1:7.5
Navy ration (Atwater)[22]	143	184	520	5,000	22.88	1:6.8
Army ration	164.2	97.8	600	4,061	25.33	1:5
Average	152	119.5	666	4,540	24.36	1:6.2
Total Carbon, 463.89 gms.	Nitrogen to Carbon, 1:19.4.					

As compared with the United States Army ration, included in the above table, the average of these dietaries is seen to be slightly in excess in fats, carbohydrates and fuel value, but deficient in protein. On the whole, however, the difference is not great, and the sufficiency in amount and proper proportion of the food provided for the soldier serving in the more northern portion of this country is abundantly demonstrated.

In the warmer portions of the temperate zone, but still well outside the tropics, the quantities of the several proximate principles required by the inhabitants are markedly inferior to the figures above given. The dietaries of these regions have not been as thoroughly studied as in countries lying in a cooler climate, but the following data are sufficiently comprehensive to be of both interest and practical importance.

TYPICAL WORKING DIETS OF THE SOUTHERN PORTION OF THE TEMPERATE ZONE.

	Protein, gms.	Fats, gms.	Carbo-hydrates, gms.	Fuel Value, calories.	Nitrogen, gms.	Nutritive Ratio (Protein to Energy).
Italy.						
Mechanics (Manfredi)[23]	76	38	396	2,290	10.55	1:6.3
Army ration, peace (Moleschott)[24]	114	14	592	3,095	18.24	1:5.5
Japan.						
Prisoners at work, Tokio (Eijkmann)[25]	66	9	544	2,585	10.66	1:8.5
United States (Mexican).						
New Mexico, families (Goss)[26]	68	73	572	3,320	10.88	1:8.3
United States (Negro).						
Southern Gulf States, families (Atwater and Woods)[27]	62	132	436	3,270	9.90	1:11.8
Average	77	53.4	508	3,012	10.72	1:8

These figures, however, are based upon races, with the exception of the United States negro, of less body-weight than those of colder climates, and hence are not properly comparable with similar figures for the latter class until reduced to a common standard in this respect, since, according to Church,[28] the capacity for muscular work may be considered as closely related to body-weight. If it be assumed that laborers in the southern portion of the temperate zone have an average weight of 125 pounds, while the corresponding class in the cooler part of the same zone has an average weight of 145 pounds—about that of the mean for the United States Army—the above average figures should be corrected as follows:

Protein, gms.	Fats, gms.	Carbo-hydrates, gms.	Fuel Value, Calories.	Nitrogen, gms.	Nutritive ratio, (Protein to Energy).
89.3	61.94	589.28	3493	14.3	1:8
Total Carbon, 354.73 gms.			Nitrogen to Carbon, 1:24.8		

While the foods habitually used by natives of the tropics are well known to differ widely in character from those employed in temperate climates, and while the existence of a certain deficiency in the native dietary in the matter of protein and fats

has long been recognized, there has been but little investigation as to the force value of the tropical dietary or to the exact quantities and relative proportions of the several proximate principles entering into its composition. Recourse to several large medical and technical libraries, together with application to the Department of Agriculture for information on this subject have, however, shown that the question of tropical dietaries has been locally studied by Maurel,[2] in the Island of Gaudeloupe; by Church,[28] in British India; by Eijkman,[29] in Jave and by Lapicque,[30] in Abyssinia. The results obtained by these investigators in diverse portions of the tropical zone, although but few in number, nevertheless agree so closely in all respects that they may be accepted as conclusive and their average as fairly representing the nutrient standard of the laboring class of natives throughout the tropics. Using figures given by Maurel,[2] the average diet for the West Indian native, at hard labor, appears to be made up about as follows:

Articles.	Amount in gms.	Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen, gms.	Fuel Value Calories.
Fresh beef	20.0	3.16	-----	2.94	0.470	38
Chicken and fish (mullet), average	40.0	12.80	-----	8.40	1.344	30
Rice	340.2	13.60	268.75	26.53	4.245	1082
Yams	566.0	1.13	141.78	5.66	0.905	616
Bananas, ripe	566.0	3.39	118.86	7.35	1.176	575
Sugarcane	340.2	----	52.25	5.06	0.800	234
Total	1872.4	34.08	581.64	55.94	8.940	2575

Total carbon, 302.85 gms.	Nitrogen to carbon, 1:37.8

Eijkmann[29] gives the ordinary food eaten by the Malay as consisting, per day, of 800 to 1,200 grams of boiled rice, 150 to 200 grams of ducks' eggs, 60 grams of meat or fish, 150 to 250 grams of pastry rather free from fat, and a varying amount of fresh fruits. The average diet of a number of Malay laborers was determined by him to have the following composition:

Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen. gms.	Fuel Value, Calories.	Nutritive Ratio (Protein to Energy).
30.2	471.9	73.3	11.73	2512	1:7.4

Lapicque[30] states that the native Abyssinian soldiers in the Italian service at Massowah subsist almost entirely on the native durrha (Kafir corn) made into cakes without fat; various sharp sauces, and sometimes ground beans or lentils, being used as accessories. Meat is eaten not more than once weekly and is regarded rather as a condiment than a staple article of food. As a result of a large number of analyses the dietary of the Abyssinian soldier was found by Lapicque[30] to be made up as follows:

Fats. gms.	Carbo-hydrates, gms.	Protein, gms.	Nitrogen. gms.	Fuel Value, Calories.	Nutritive Ratio (Protein to Energy).
30.0	360.0	50.0	8.0	2100	1:8.7

In British India, according to Church,[28] the coolie rarely tastes animal food of any character, but subsists almost entirely upon rice and soy beans; the latter containing a large proportion of vegetable oil as well as nitrogen. This ordinary diet of the coolie laborer, in proximate composition and food value, is thus determined by Church:

Fats, gms.	Carbo-hydrates, gms.	Protein, gms.	Nitrogen, gms.	Fuel Value, Calories.	Nutritive Ratio (Protein to Energy).
33.1	355.8	61.6	9.69	2013	1:7.7

The average of the above four tropical dietaries is as follows:

Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen, gms.	Fuel Value, Calories.	Nutritive Ratio (Protein to Energy).
31.8	442.2	60.21	9.63	2300	1:8.8

For purposes of comparison, however, these figures, like those for the inhabitants of the warmer portions of the temperate zone, must be reduced to the common standard of body weight of 145 pounds—the average weight of laborers in the undersized races of the tropics being regarded as about 115 pounds—and the above figures are thus proportionately increased as shown in the following table:

Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen, gms.	Fuel Value, Calories.	Nutritive Ratio (Protein to Energy).
40.0	560.01	76.18	12.18	2900	1:8.8
Total carbon, 318.13 gms.			Nitrogen to carbon, 1:26.1		

On contrasting the several dietaries which have been shown to obtain with men having an average weight of 145 pounds, engaged at hard muscular labor, in the northern portion of the temperate zone, the southern portion of the temperate zone and in the tropics, the difference in the quantity and character of food taken is seen to be most marked, particularly in relation to the protein and fats. The difference in force value between these dietaries is also very great, and even the carbohydrates, contrary to usual ideas, are diminished in the tropics in no small degree. These typical dietaries are shown in the following table:

Climate.	Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen, gms.	Carbon, gms.	Fuel value, calories.	Relation of nitrogen to carbon.	Nutrient ratio (protein to energy).
Northern portion of Temperate Zone	119.5	666.0	152.00	24.36	463.89	4540	1:19.4	1:6.2
Southern portion of Temperate Zone	61.9	589.2	89.30	14.30	354.73	3493	1:24.8	1:8.0
Tropics	40.0	560.0	76.18	12.18	318.13	2900	1:26.1	1:8.8

It may, however, be urged that the marked variation in the composition and force value apparent in the above dietaries is due rather to racial preference than to climatic influence. This claim would scarcely appear to be well founded. It is a matter of common observation that natives of the tropics removed to colder climates soon adopt the dietetic customs of the region in which they may be resident. Further, it should be noted that Atwater and Woods[27] showed the average daily consumption of food in twenty negro families in the rural districts of Southern Alabama to consist of 62 grams of protein, 132 grams of fats and 436 grams of carbohydrates and to possess a force value of 3,012 calories; while Frissell and Bevier[31] found that the average dietary of nineteen negro families of the same class, resident in Northern Virginia, yielded 109 grams of protein, 159 grams of fats and 444 grams of carbohydrates, with a force value of

3,745 calories. It is idle to assume that this great difference in the composition and nutrient value of the dietaries for corresponding classes of the same race, resident in different latitudes, can be dependent upon other than climatic conditions. It is evident, therefore, that the food of human beings, both in relative proportion and nutrient quality, varies directly with temperature as approximately expressed by latitude.

The standard dietaries having been established for laboring men performing hard work under diverse climatic conditions, it becomes necessary to examine the present United States Army ration with a view of ascertaining the nutritive value of its several components, and determining whether the quantities in which their issue is authorized will permit their combination in a daily allowance, not only desirable in theory and well qualified to maintain the health and vigor of the soldier, but also thoroughly practicable under all conditions of military service.

The following table, compiled from data elaborated by Atwater and Bryant,[82] shows the chemical composition and nutrient values of the various articles of the ration; the soap and candle, coffee and seasoning components, which are merely accessory to the nutritive articles and possess little if any force value, not being taken into consideration as requiring no alteration in quantity for the tropics:

From the above table it is apparent that the ordinary variation of the articles composing the food of the soldier, as contemplated in the establishment of the ration, does not furnish dietaries of the same proximate composition or nutritive value. How great this difference may be, from day to day, it is of importance to determine.

Using the figures just given, the proximate composition and nutrient value of the maximum quantity of food material which may be drawn as a daily allowance by the United States soldier is seen to be as follows:

Articles.	Quantity in ounces.	Fats, gms.	Carbo-hydrates, gms.	Protein, gms.	Nitrogen, gms.	Fuel value, calories
Fresh beef	20.0	89.50	----	83.35	13.30	1,180
Flour	18.0	5.60	380.46	55.08	7.90	1,850
Beans	2.4	1.22	40.18	15.16	2.42	240
Potatoes	16.0	0.45	81.70	9.50	1.52	380
Dried fruit	2.0	1.02	33.80	1.18	0.19	147
Sugar	2.4	---	64.60	---	----	264
Total	60.8	97.79	600.74	164.27	25.33	4,061

Total carbon, 427.03 gms. Nitrogen to carbon, 1:17.

Articles of Ration.	Quantities per Ration. Ounces.	Per Cent of					Amounts Present in Ration. (Gms.)				Fuel Value per Ration. Calories.
		Water.	Protein.	Nitrogen.	Fat.	Carbo-Hydrates.	Protein.	Nitrogen.	Fat.	Carbo-Hydrates.	
Fresh beef (fore and hind quarters)	20	50.5	14.7	2.35	15.8	----	83.35	13.3	89.5	----	1180
or fresh mutton	20	43.8	16.3	2.60	22.2	----	92.4	14.7	125.8	----	1440
or pork	12	16.2	16.2	2.59	66.2	----	55.08	8.8	225.08	----	2187
or bacon	12	16.8	9.2	1.47	61.8	----	31.28	4.99	210.12	----	2085
or salt beef	22	49.6	14.2	2.27	22.8	----	88.6	14.16	142.3	----	1534
or dried fish (cod)	14	40.3	16.00	2.56	0.4	----	63.52	10.16	1.59	----	276
or fresh fish (cod, whole)	18	38.7	8.00	1.28	0.2	----	40.8	6.5	1.02	----	155
Flour	18	12.8	10.8	1.55	1.1	74.6	55.08	7.9	5.6	380.46	1850
or soft bread	18	35.4	9.5	1.36	1.2	52.8	48.45	6.9	6.12	269.28	1355
or hard bread	16	9.2	14.4	2.30	1.3	72.8	65.7	10.44	5.9	330.5	1712
or corn meal	20	12.9	8.9	1.41	2.2	75.1	50.4	7.99	12.4	425.8	1986
Beans	2 2/5	13.2	22.3	3.56	1.8	59.1	15.16	2.42	1.22	40.18	240
or rice	1 3/5	12.4	7.8	1.24	0.4	79.00	3.5	.56	.18	35.55	163
or peas	2 2/5	10.8	24.1	3.85	1.1	61.5	16.38	2.62	.75	41.8	246
or hominy	1 3/5	11.9	8.2	1.31	0.6	78.9	3.69	.59	.27	35.5	172
Potatoes	16	78.9	2.1	0.336	0.1	18.00	9.5	1.52	.45	81.7	380
or potatoes 80% and onions 20%	16	78.8	1.9	0.312	0.16	16.1	8.6	1.4	.72	73.09	340
or potatoes 70% and canned tomatoes 30%	16	83.7	1.8	0.288	0.13	13.8	8.16	1.30	.58	62.59	297
Dried fruits (average varieties issued)	2	29.5	2.09	0.334	1.8	59.7	1.18	.19	1.02	33.8	147
Sugar	2 2/5	----	----	----	----	95.00	----	----	----	64.6	264
or molasses	16/25 gill	25.1	2.4% nitrogenous matter present, probably not protein.		----	69.3	----	----	----	41.25	198
or cane syrup	16/25 gill	----	----	----	----	69.5	----	----	----	41.36	198

In the following table are included those articles of food which, taken together, may be considered to constitute the ordinary ration for troops in the field or during campaign:

Articles.	Quantity in ounces.	Fats, gms.	Carbo-hydrates, gms.	Protein, gms.	Nitrogen, gms.	Fuel value, calories
Bacon	12.0	210.12	----	31.28	4.99	2,085
Hard Bread	16.0	5.90	330.50	65.70	10.44	1,712
Beans	2.4	1.22	40.18	15.16	2.42	240
Dried fruit	2.0	1.02	33.80	1.18	0.27	147
Sugar	2.4	---	64.60	---	---	264
Total	34.8	218.26	489.08	113.26	18.12	4,448

Total carbon, 432.78 gms. Nitrogen to carbon, 1:23.8.

A selection of food-stuffs which may fairly be assumed to represent the usual dietary of the soldier in garrison is shown in the following table:

Articles.	Quantity in Ounces.	Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen, gms.	Calories.
Fresh beef	20.0	89.50	-----	83.35	13.30	1180
Soft bread	18.0	6.12	269.28	48.45	6.90	1355
Potatoes and onions	16.0	0.72	73.09	8.60	1.40	340
Dried fruit	2.0	1.02	33.80	1.18	0.19	147
Sugar	2.4	----	64.60	-----	-----	264
Total	58.4	97.36	440.77	141.58	21.79	3296

Total carbon, 344.57 gms. Nitrogen to carbon, 1:16.3.

The following dietary combines the several articles of the ration which approach most closely in character to the foods commonly employed by natives of the tropics:

Articles.	Quantity in Ounces.	Fats, gms.	Carbohydrates, gms.	Protein, gms.	Nitrogen. gms.	Calories.
Fresh fish, cod, whole	18.0	1.02	-----	40.80	6.50	155
Soft bread	18.0	6.12	269.28	48.45	6.90	1355
Rice	1.6	0.18	35.55	3.50	0.56	163
Potatoes and tomatoes	16.0	0.54	65.80	8.17	1.36	297
Dried fruits	2.0	1.02	33.80	1.18	0.19	147
Sugar	2.4	----	64.60	-----	-----	264
Total	56.0	8.88	409.03	102.10	15.51	2321

Total carbon, 241.84 gms. Nitrogen to carbon, 1:16.7.

On consideration of the preceding four dietaries it is seen that the first combination, as compared with the average dietary for individuals of the same weight native to the tropics, presents a great excess in protein, fats and fuel value—even the carbohydrates being largely increased. In the second arrangement, the fats are present in five times the quantity apparently sufficient and desirable under tropical standards, the protein is in considerable excess and the fuel value unnecessarily high, while the deficiency in carbohydrates is noticeable. In the third dietary the fats and protein are both in excess, but the quantity of carbohydrates is markedly deficient. The force value of this combination is not far from the actual requirements of the system, in the tropics, as regards energy. In the last arrangement of the articles of the ration the protein is seen to be present in slight excess, while the fats and carbohydrates are markedly deficient, the former especially so. The force value of this dietary, also, is wholly insufficient to meet the needs of even moderate muscular labor. The conclusion is therefore justifiable that while the several articles composing the ration are well selected, the quantities in which their issue is now authorized are so proportioned that their combination in a dietary, approximately similar to the nutrient standard of native laborers in the tropics—even under conditions of equality as regards weight—is theoretically as well as practically impossible. It may therefore be accepted that the proportions of the ration as at present existing do not permit the fulfillment of proper dietary requirements under conditions of tropical service.

III. THE RATION FOR TROPICAL SERVICE.

Quantity.—Prolonged heat exerts an unfavorable influence upon the digestive and assimilative functions. Hence work should not be imposed upon the alimentary tract in excess of its powers and the diet should be restricted as compared with that of temperate climates, particularly since both diarrhea and dysentery are known to be favored by the presence of a large amount of undigested food in the intestine, while tropical anemia may be hastened by malassimilation resulting from overtaxation of the digestive powers. The respiration, as has already been shown, is much less energetic after arrival in the tropics, and this, combined with rarefaction of the atmosphere and other factors, results in a much less amount of oxygen being introduced into the blood than is the case in temperate climates. If the reduced quantity of oxygen available finds in the organism an excess of alimentary substances, it is evident that oxidation

of the latter will be delayed even if ultimately complete, and metabolic equilibrium is thus disturbed. Further, according to Foster,[33] the amount of heat evolved by the internal organs depends largely on their stimulation. In the case of the salivary gland the temperature of the saliva during irritation of the chorda has been found to be 1° to 1.5° higher than that of the blood in the carotid artery at the same time, and the same author states that, in all probability, the investigation of other secreting glandular organs, under excitement, would yield similar results. Particularly is this true of the liver, an organ in which a large amount of heat is produced, as is shown by the fact that a temperature of 40.73° C. has been observed in the hepatic vein, while that of the right heart was 37.7° C. and that of the inferior vena cava 38.35° C. Hence the excitation of the liver, either through the improper selection of foods or an excess of nutritive material requiring disposal, is to be avoided in hot climates. It is obvious that the consumption of any considerable amount of food for the production of internal heat is here as unnecessary as it is undesirable, while the nutritive needs of the organism require a smaller amount of material to repair the systemic losses resulting from the decreased oxidation and normally less active life of the tropics.

Protein and Nitrogen.—The proteid molecule, as shown by Krukenberg,[34] Pavy,[35] Schuetzenberger[36] and others, is not to be considered as a perfect chemic body, but as a complex, composite mixture of a glucosidal nature containing nitrogenous, carbohydratic and fatty radicals. Protein has been experimentally decomposed into these radicals, outside the body, by the above investigators, and it has been determined by Cohnheim,[37] Seegen,[38] Külz,[39] Mering [40] and others, through artificial conditions of diet, that the same cleavage occurs as a result of the processes of oxidation within the organism. The non-nitrogenous radicals have as their object the production of energy, and when the systemic needs are satisfied as regards nitrogen, it is obvious that, for the tropics, such force-food as may still be required is preferably supplied in the simple proximate forms not requiring such cleavage—with its necessary production of heat—and not yielding, in the process of decomposition, considerable quantities of a substance which is in excess of the immediate requirements of the organism, and, as stated by Foster,[33] can be stored up in but extremely small part and hence merely requires elimination as an excrementitious body. Particularly is this the case where the need for internal heat is obviously lessened and where the renal function, from the causes already mentioned, operates at a disadvantage. It is hence extremely im-

portant that protein be supplied in the tropics purely for the purpose of systemic repair and not be relied upon for the creation of any considerable proportion of the energy required by the organism. The ingestion of a certain amount of nitrogen is indisputably necessary to health, and with its deficiency the food ceases to be digested and a condition of inanition ensues. This, however, is no argument for its supply in excessive amount, and the nitrogenous intake—for the most satisfactory accomplishment of the metabolic processes—should be directly proportioned to body waste. According to Gayet,[41] the average man at ordinary labor, in the temperate zone, loses 20 grams of nitrogen daily, nearly all of which is in the urine. Eijkman,[12] in Java, found that the average excretion of nitrogen in a similar class of Malays was 7.817 grams, which, being reduced to a common standard of weight at 145 lbs.—the Malays averaging 111 lbs.—gives 10.21 grams, or about one-half the quantity ordinarily eliminated in temperate regions. The nitrogen, in the standard diets for laboring men in cool climates, proposed as above by Playfair,[16] Moleschott,[24] Atwater[15] and others, varies from 19.35 grams to 20.29 grams. Notter and Firth[42] give 11.6 grams as the daily allowance for a mere subsistence diet in temperate regions and state that even as much as 32 grams may be required during great exertion. On referring to the table given elsewhere, showing the dietaries actually employed by laboring classes in the tropics, reduced to the above standard of weight for purposes of comparison, it is seen that the hard working native of the low latitudes ingests an average of 12.83 grams of nitrogen, or an amount only slightly in excess of the requirements for bare subsistence in temperate climates. This deficiency in the amount of nitrogen ingested by the native is, however, apparent rather than real, for the above quantity, small though it may seem, has been shown by experience through untold generations to be not only sufficient for the maintenance of life and health in the tropics, but also ample for the greater demands upon the organism resulting from labor. Maurel,[2] in his study of the natives of Guadeloupe and Guiana, found that their diet was almost wholly vegetable. From estimates based on official figures, he showed that the inhabitants of Guadeloupe used a daily average of only twenty grams of meat per capita, and that only one-seventh of the vegetable food was imported in the form of the cereals of the temperate zone, the remaining six-sevenths being made up of yams, cassava, sweet potatoes, bananas, mangoes and other fruits. Similar customs as regards food are said by Eijkman[12] to prevail among the Javanese Malays, and in India and Abys-

sinia, Church[28] and Lapicque[30] found that the native rarely used animal material in any form. For natives of the tropics it may therefore be accepted that the vegetable kingdom is almost wholly the source from which their food is drawn, and that but little of the vegetable material so used is imported in the form of cereals grown in cool climates. These facts are extremely important, for data supplied by the Department of Agriculture[48] show that fruits and vegetables grown in the tropics, at least as far as the western hemisphere is concerned, are much less rich in nitrogenous constituents than are the vegetable foods indigenous to the temperate zone. A comparison of the vegetables most commonly employed as staple foods in the tropics and in cool climates, shows the following differences:

VEGETABLE FOODS CHIEFLY USED IN THE TROPICS.

	Water, per cent.	Protein, per cent.	Nitrogen, per cent.	Fat, per cent.	Carbohydrates, per cent.	Crude Fiber, per cent.	Ash, per cent.
Cassava	61.30	0.64	0.102	0.17	36.50	0.88	0.51
Sweet potato (edible portion)	69.0	1.80	0.288	0.70	26.10	1.30	1.10
Yam	71.86	1.00	0.160	0.20	25.05	1.03	0.86
Sugar cane	75.41	1.49	0.230	----	15.36	7.04	0.69
Ripe bananas (edible portion)	75.3	1.3	0.208	0.6	21.0	1.0	0.8
Rice	12.3	8.0	1.280	0.3	78.8	0.2	0.4

Average amount of nitrogen, per cent., 0.378.

VEGETABLE FOODS CHIEFLY USED IN TEMPERATE CLIMATES.

	Water, per cent.	Protein, per cent.	Nitrogen, per cent.	Fat, per cent.	Carbohydrates, per cent.	Crude Fibre, per cent.	Ash, per cent.
White potato (edible portion)	78.3	2.2	0.352	.1	18.0	.4	1.0
Wheat flour	12.8	10.8	1.552	1.1	74.6	.2	.5
Oatmeal	7.3	16.1	2.575	7.2	66.6	.9	1.9
Corn meal, granular	12.5	9.2	1.472	1.9	74.4	1.0	1.0
Barley flour	11.9	10.5	1.520	2.2	66.3	6.5	2.6
Rye	12.7	7.1	1,135	.9	78.5	----	.8

Average amount of nitrogen, per cent., 1.434.

In these two groups of food-stuffs the great inferiority of the vegetable diet of the native in the tropics, as regards available nitrogen, is at once apparent, the vegetable and cereals most commonly used as food in the temperate zone containing, in a given weight, almost exactly four times more nitrogenous material. Hence it is evident that the native diet in the tropics is doubly inferior as regards nitrogen, meat being but little used, while the vegetable foods which replace the cereals of temperate climates, contain but a small proportion of this element.

The fact may here be emphasized that nature has laid down certain laws as regards alimentation which it is the highest wisdom to follow. It is not a matter of theory, but an unrecognized chemical instinct which leads the native of the tropics to make his choice of diet and nature's provisions of aliment accord so closely. The inhabitants of warm climates, civilized and savage, succeeded in properly adjusting their diet through experience alone long before any theories as the proper diet for such climates were advanced, and it is worthy of note that not only is a light vegetable diet, containing proportionately little nitrogen, sufficient to maintain health and strength in the native of the tropics, but whites even, who may have been born in hot countries, intuitively adopt a similar regimen and thrive upon it. Habit, in the use of certain classes of food-stuffs, certainly operates against a change of diet, yet Eijkman[12] found, in Java, that the food of resident whites—born in Europe—approached the native dietary, presenting a marked decrease in both protein and fats. Analyses of this modified European diet gave an average of 99.6 grams of protein, 83.8 grams of fats and 284.2 grams of carbohydrates. The fact that an excess of meat in any form, greasy meat especially, soon becomes distasteful in the tropics, is certainly a powerful argument for an alteration of diet in favor of a diminution of protein as well as fats.

The most striking effect of a highly nitrogenous diet is the increase in the nitrogenous metabolism of the body, and to a lesser degree of the non-nitrogenous also. This increased metabolism, through the amount of heat necessarily generated in the process, is clearly undesirable in warm climates. Further, the deficient supply of oxygen available in the tropics impairs the combustion of proteids, and under such conditions the overloaded system habitually contains an undue amount of unoxidized nitrogenous matter, which in an oxidized state would be expelled by the kidneys. Albuminates and nitrogenous compounds generally, undergo change and are excreted principally as urea, therefore an excess of albuminous food throws more

work on the kidneys, which may induce disease. Nitrogenous matter being in excess and the secretion of the urine by the kidneys being decreased, there may be deposits in the urinary passages in the shape of uric acid, or in other parts as urates, through the lack of sufficient fluid for their solution.

As to the liver, Rochard,[44] Moore,[13] Nielly,[14] Rattray,[5] Jousset,[8] Maurel,[45] Treille[46] and others have observed the directly injurious influence of a too nitrogenous and greasy diet in the production of disorders of this organ. Hepatic disease, while extremely common among the whites of India and other tropical regions, is rare among the native population. The idea has been advanced that the native enjoys an immunity to this affection as a result of acclimation rather than diet; but this theory is contradicted by Maurel,[45] who states that he, with others, has repeatedly seen congestion of the liver occurring in natives of the tropics, who, a few months before, by reason of circumstances had adopted the much more nitrogenous diet of the temperate zone. This view is upheld by a recent medical publication,[46] which calls attention to the greatly increased liability to disease of the liver among Asiatics who have become semi-Europeanized and connects it with the fact that these individuals crave and use the same bulk of the more concentrated and nitrogenous diet of the European as they do of their own native foods. Further, to show the injurious effect of a nitrogenous diet in hot countries, laboratory experiments are not wanting. Maurel,[45] in Guiana, fed a series of rabbits upon a vegetable diet, while another group was fed entirely on cheese. The investigation extended over a period of ten months and the results were conclusive, showing a less increase in the weight of the first group than occurred in the cheese-fed rabbits. Not only also was the total weight of the second series of animals much greater than that of the first, but the disparity in hepatic enlargement was even more marked, the livers of the latter class not only showing disproportionate increase in size, but also exhibiting manifest changes, being hard, mottled and presenting a condition of hypertrophic cirrhosis. In a second series of experiments the results, though positive, were slightly less marked, since the experimental feeding continued for only six instead of ten months and the influence of a nitrogenous diet was not so pronounced upon the liver. The following results were obtained by him:

DURATION OF EXPERIMENT, 10 MONTHS, JUNE 1881, TO APRIL 1882.

	Total Weight.		At the End of the Experiment.	
	Before Experiment.	After Experiment.	Weight of Liver.	Relation of Weight of Liver to total Weight.
Rabbit No. 1 (vegetable diet)	650 gm.	1210 gm.	37 gm.	1:32.70
Rabbit No. 2 (cheese diet)	580 gm.	1780 gm.	86 gm.	1:20.69

SECOND EXPERIMENT, DURATION 6 MONTHS, APRIL, 1882, TO OCTOBER, 1882.

Rabbits, Diet.	Total Weight.		At the End of the Experiment.	
	Before Experiment.	After Experiment.	Weight of Liver.	Relation of Weight of Liver to total Weight.
No. 1 Vegetable	629 gm.	1160 gm.	33 gm.	1:35.15
No. 2 Vegetable	645 gm.	1880 gm.	44 gm.	1:42.72
No. 3 Cheese	467 gm.	1365 gm.	48 gm.	1:28.44
No. 4 Cheese	565 gm.	1370 gm.	45 gm.	1:30.44

For the three rabbits given a vegetable diet, the ratio of the weight of the liver to the total body weight was 1:36.85 at the time of death, while the ratio for the cheese-fed rabbits in this respect was 1:26.52. In view of the clinical experience and experimental results, as noted above, no further argument as to the influence of a too nitrogenous diet in the tropics, in provoking liver disease, is required.

From what has been said it is evident that the nitrogenous constituents of the United States Army ration, for troops serving in the tropics, may be safely and advantageously reduced. This is preferably accomplished at the expense of the meat component, which, besides protein, also contains a considerable proportion of fats. A complete fall to the nitrogenous level of the native of the tropics is, however, undesirable, since a single nutrient standard for the military service must always contain within itself the elements necessary in emergency to repair the losses incident to the greatest physical effort of which the human being is capable. For this reason the daily allowance of protein

provided for the soldier, unless separate dietetic standards for conditions of peace and war prevail, must necessarily be in considerable excess of the actual needs of the organism under ordinary circumstances. Hence it is probable that the daily allowance of nitrogen cannot be safely reduced below 16 grams—represented by 100 grams of protein—even though this amount is in considerable proportionate excess of the nitrogenous normal of the corresponding native class of the tropics.

Fats.—In hot climates, where the human organism instinctively feels the need of a loss of heat rather than its creation, the consumption of fat—a heating food of the highest degree—should be reduced to the minimum and largely replaced by that of sugars and starches. Rubner[48] calculated that 100 parts of fat, burned within the body, yield as much heat as 232 parts of starch or cane sugar, and the distaste for fats in any considerable quantity, so early acquired in the tropics and so noticeable during the summer weather of temperate climates, may be considered as evidence of an unconscious but instinctive recognition of the fact that a dietary of decreased caloric value is sufficient for the needs of the organism exposed to high temperatures, the more concentrated heat-producers being rejected while the desired distention of the stomach is secured by bulky vegetable foods of lower potential value. This dislike of fat under conditions of high temperature is too fully appreciated to require the production of evidence on this point. It is of interest, however, to recall the aversion with which the ration of bacon was regarded by troops in Cuba and Porto Rico during the war with Spain, while Cardwell[49] reported from Manila that "salt meat (bacon) was in great part wasted and need not have been issued except in sufficient quantity to provide cooking fat."

As compared with carbohydrates, fats, as a whole, are notably less digestible and thus increase the evolution of heat through the more active chemical processes in the intestine. Furthermore, they are burned with more difficulty within the organism, since there is sufficient oxygen in the carbohydrate itself to form water with the hydrogen present, while fats require additional oxygen to combine with their hydrogen for their combustion and elimination. Hence, in herbivora, according to Foster,[33] a larger proportion of the oxygen consumed reappears in the form of carbonic acid than is the case with carnivora, subsisting chiefly on proteid and fat. That this difference is by no means small is shown by the fact that the so-called respiratory quotient, obtained by dividing the excretion of carbonic acid by the consumption of oxygen by volumes, is about 0.9

in herbivora and about 0.7 in carnivora, a difference of 22 per cent. In the tropics, however, it has already been shown that there is a greatly diminished value, as regards oxygenation, to the respiratory act, and under such circumstances the amount of oxygen, already small, available for the needs of the organism as regards the elimination of carbon, would be seriously encroached upon in the oxidation of a diet largely composed of fatty material. Furthermore, an excess of hydrocarbons in the food calls for increased hepatic action in the production of bile, since it has been abundantly demonstrated that the latter is a prominent factor in the digestion of fats, as shown by the fatty stools which follow obstruction or ligature of the bile ducts. That this hyper-stimulation of the liver—with its many evil results, elsewhere discussed—actually does occur in the tropics, where more fats are introduced into the system than can be readily utilized, is shown by the bilious diathesis, so common among high-livers in warm climates, as characterized by excessive bile production and later by hepatic congestion. Fats and carbohydrates are much more akin to each other than is either to proteid, and if, as stated by Foster,[83] fat may be converted into sugar either when about to be incorporated into the organism or when being decomposed into its ultimate products, it might reasonably be expected that carbohydrates and proteid, with little or no fat, would form a satisfactory diet. That this conclusion is, in practice, largely borne out by facts is shown by reference to the foregoing tables, in which the fatty constituents of the vegetables ordinarily composing the diet of the native of the West Indies is only 0.32 per cent, while the corresponding part of the diet in temperate climates contains 2.23 per cent., or an amount seven-fold greater. On this point, however, experience is probably to be trusted. Natives of hot countries, when they can afford it, generally use a small amount of fats as such—as the clarified butter of India, the salt pork of tropical America, the olive oil of the Mediterranean districts and the palm oil of equatorial Africa—and it is probable that a small quantity of such material, together with the proteid and carbohydrates, assures a better use of the alimentary principles and reduces to a minimum the quantity of each which should be ingested. While it may, then, be conceded that a certain quantity of fatty food is a desirable component of the diet in warm climates, it is certainly true that the amount so taken should be relatively small, and that the proportion commonly maintained in temperate climates is far in excess of the needs of the organism in the tropics. This fact is demonstrated beyond the possibility of question by referring to the average dietary for men at hard

work in the north temperate region and that for the corresponding class in the tropics, as given elsewhere, the fats and carbohydrates being seen to exist in the ratio of 1:5.5 in the cold climates, while in the tropical dietary the relative proportion is 1:14 for men of the same weight. With such wide variation in the relation to these proximate principles, and in view of the fact that a considerable diminution in protein has also been shown to be desirable, it is evident that a sudden reduction of fat in the ration to the low standard of the tropical dietary might readily provoke such alteration of metabolic function and such interference with existing processes of digestion as would result in serious discomfort and positive detriment to the individual. The dietetic customs of a lifetime cannot be entirely changed in a day, and a stomach accustomed to rich and concentrated food would undoubtedly find difficulty in at once properly digesting a far more bulky and less nutritious diet composed chiefly of vegetable material. For the newcomer in the tropics, habit as well as climate must be given consideration in the selection of diet, and it is therefore probable that no smaller proportion than that of one part of fats to ten of carbohydrates would be to the best interests of the United States soldier.

Carbohydrates and Carbon.—Carbohydrates are justly regarded as the chief source of carbon supplied to the organism in the production of energy. This, however, is due rather to the much greater quantity of carbohydrates ingested, as compared with the fat and protein constituents of the ordinary diet, than to a high proportion of this element in the carbohydrate itself, for the amount of carbon in starch and sugar is relatively low. Notter and Firth[42] state that carbohydrate contains only 44 per cent. of carbon, where fat contains 76.5 per cent. and even protein contains 53 per cent. Through the considerable quantity of protein which enters into the diet it is evident that the latter plays no small part in determining the carbon intake, as utilized for the creation of energy. The urea of the urine practically represents the whole of the nitrogen which passes from the body, and in any given quantity of urea the amount of carbon is far less than that found in the quantity of protein containing the same amount of nitrogen. Foster[53] states that the percentage composition of the two is as follows:

	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.
Urea	25.00	6.66	26.67	46.67	----
Protein	53.00	7.30	23.04	15.53	1.13

It is thus readily seen that 100 grams of protein, which have been suggested as furnishing about the amount of nitrogen desirable for the daily allowance of the United States soldier in the tropics, contains as much nitrogen as 33.3 grams of urea, but the 100 grams of protein contain 46.4 grams more carbon than do the 100 grams of urea (53:6.66, or about the proportion of 8:1). Hence the daily allowance of protein, for tropical service, in passing through the body and giving rise to urea, would leave behind 46.4 grams of carbon to combine with oxygen and undergo elimination as carbon dioxide. It has been shown that the average diet of laboring men, at hard muscular work in the cooler portion of the temperate zone, contains 152 grams of protein, and reduction in this respect to 100 grams, the proposed standard for the tropics, implies a loss of 24.12 grams of carbon previously available for purposes of energy. It is true that a certain amount of protein taken in as food, as shown by Mallet,[50] is not directly decomposed to the comparatively simple forms of urea and carbon dioxide, but, retaining a greater proportion of carbon, is excreted as creatinin or uric acid—bodies which, intermediate between protein and urea, form a series in which the proportion of nitrogen becomes larger and the carbon smaller—and it is probable that the amount of these substances is considerably increased in the tropics through the deficiency of oxygen available for the metabolic processes of the organism. In quantity, however, they are undoubtedly at all times so small as to be safely disregarded for the purposes of the present calculation.

As regards fats, as stated above, carbon enters into their composition to the amount of 76.5 per cent., and it has been shown that, for the tropics, the proportion of one part of fats to ten of carbohydrates, in the dietary, probably redounds to the best interests of the American soldier. On referring to the table giving the proximate composition of the average diets of hard-working men in the cooler portion of the temperate zone, it is seen that the amount of fats ingested by this class, 119.5 grams, would be reduced, according to the above proportion, to 66.6 grams, or, in round numbers, to a daily allowance of about 65 grams in hot climates. This amounts to a reduction of 54.5 grams of fats and 41.69 grams of carbon, making the loss in carbon due to diminution in the fat and protein constituents amount to 65.76 grams daily. The average working diet for cool climates, just referred to, contains 453.39 grams of carbon available for the maintenance of body heat and the performance of external muscular work; this quantity, on subtracting the 56.77 grams of this element withdrawn from the

same diet through proposed reduction in fat and protein, being reduced to 387.63 grams. But it has been shown that the native of the tropics performs hard labor on a diet which, even when proportioned for an average weight of 145 lbs., yields only 319.16 grams of carbon presumably available for purposes of energy. It is undoubtedly true that this relatively small amount of carbon required by the native of the tropics expresses to a considerable degree the lessened amount of energy necessary in the maintenance of body heat in hot climates, and hence approximation to the carbonaceous level of the native dietary would undoubtedly be desirable if the nutrient allowance for the soldier could be based upon requirements as to energy which, even if considerable, are at least fairly uniform. Unfortunately, however, for dietetic ideals—and undoubtedly, also, for the physical welfare of troops on duty in the tropics—a single fixed nutrient standard, as has already been advanced, must be determined with reference to the excessive requirements of infrequent emergency rather than to the ordinary conditions of military service. It has been stated that a greater part of the carbon oxidized within the organism is derived from carbohydrates, the latter being regarded purely as a force food and as the chief source of energy within the body. Carbohydratic material is capable of largely replacing fat in the dietary, diminishes nitrogenous metabolism, yields no end-products to be excreted by the kidneys, is readily assimilated and, when in excess, is largely stored up within the organism as glycogen and adipose tissue. The ingestion of carbohydrates, therefore, in quantities greater than are required for the immediate needs of the economy, while not without certain untoward effects upon the system, is undoubtedly far less inimical to health than where there is an excess of protein or fat in the dietary for the tropics. It is probable, therefore, that further reduction in carbon for the proposed tropical ration need not be great, as far as any seriously unfavorable effect upon the organism is concerned, considering at the same time, that a certain carbonaceous excess in the tropical ration, as compared with native standards, may justly be regarded as a reserve of energy upon which the soldier may draw at such time as the routine duties of garrison are exchanged for the arduous labors of campaign. For this reason, it may be accepted that the tropical ration should be capable of supplying about 380 grams of carbon available for purposes of energy, not including the carbon required in the formation of urea. This quantity is yielded by the proximate principles of the subjacent dietary.

THE TROPICAL RATION.—From what has been advanced it

is seen that the proportionate composition and fuel value of the proposed standard dietary for United States troops, serving in the tropics, is as follows:

Protein, gms.	Fats, gms.	Carbo-hydrates, gms.	Nitrogen, gms.	Total Carbon, gms.	Fuel Value, Calories.	Nutrient Ratio (Protein to Energy).
100	65	650	16.0	392	3491	1:8

The proximate alimentary principles, whose quantities and relative proportions are given in the above nutrient standard for the tropics, can be properly apportioned in the ideal ration for hot climates only as a result of an accurate knowledge of the percentage composition of such articles of food as may be selected to enter into its composition. The determination of these food-stuffs, for the American soldier, is an easy task. The present United States Army ration, as already stated, is made up of admirably selected articles in more than sufficient variety, and it is therefore not only wholly unnecessary, but quite inadvisable to consider, in this connection, any nutritive substances outside those articles legally established as components of the food for the United States soldier. The proximate composition of these has long since been determined—as given elsewhere—and hence the matter resolves itself into the simple problem of so proportioning the quantities of the nutrient articles already provided that, when brought together in varying combination, the resulting dietary will in each case approach the theoretical standards to a reasonable degree. It is not, however, intended that the daily intake of the several proximate principles shall exactly correspond with the quantities laid down therein, for this is manifestly impracticable for the military service, and, even if its accomplishment were secured, it is more than doubtful if there would be any resulting advantage. The economy readily adapts itself, in the matter of food, to present necessity, and slight deficiency in any nutritive principle is readily made good, particularly in the matter of fats and carbohydrates, from the reserve of these materials stored up within the organism, small systemic losses being subsequently compensated for by corresponding excess. It is true, also, that the needs of the economy, as shown by appetite, are subject to wide variation, and hence it may be accepted that slight but carefully considered alteration in the constituents of the daily dietary, far from being detrimental, is productive of actual benefit. It is obvious, also, that the soldier will require less nutriment in garrison than is neces-

sary to furnish the energy for the greater labors of campaign, and hence the several components of the ration should be so proportioned as to furnish dietaries properly varying in potential and nitrogenous value. It is believed that this is accomplished in the following modifications of the dietaries already shown to be most commonly used by the United States soldier in temperate climates, the subjoined table showing the nutrient value of a proposed dietary for the tropics containing the greatest amount of food material which can be drawn by the soldier:

TROPICAL DIETARY, I.

Articles.	Quantity, oz.	Fats, gm.	Carbohydrates, gm.	Protein, gm.	Nitrogen, gm.	Fuel value, Calories.
Fresh beef	10	44.75	---------	41.68	6.67	590
Flour	18	5.60	380.46	55.08	7.90	1850
Beans	2.4	1.22	40.18	15.16	2.42	240
Potatoes	16.0	0.45	81.70	9.50	1.52	380
Dried fruit	3.0	1.53	33.80	1.77	0.27	220
Sugar	3.5	------	94.25	-------	-------	397
Total	52.9	53.55	630.39	123.19	18.78	3677

Total carbon, 395.14 gm. Nitrogen to carbon, 1:19.6.

The following table shows a proposed dietary for the tropics, especially applicable to field service, in which the fatty constituents attain their maximum and the potential energy is high:

TROPICAL DIETARY, II.

Articles.	Quantity, oz.	Fats, gm.	Carbohydrates, gm.	Protein, gm.	Nitrogen, gm.	Fuel value, Calories.
Bacon	6	105.06	---------	15.64	2.49	1042
Hard bread	18	6.63	371.81	73.12	11.74	1926
Beans	2.4	1.22	40.18	15.16	2.42	240
Dried fruit	3.0	1.53	50.70	1.77	0.27	220
Sugar	3.5	------	94.25	-------	-------	397
Total	32.9	114.44	556.94	105.69	16.92	3825

Total carbon, 328.76 gm. Nitrogen to carbon, 1:23.

The nutrient value of the ordinary dietary as proposed for garrison duty in the tropics is as follows:

TROPICAL DIETARY, III.

Articles.	Quantity, oz.	Fats, gm.	Carbohydrates, gm.	Protein, gm.	Nitrogen, gm.	Fuel Value, calories.
Fresh beef	10	44.75	-----	41.68	6.67	590
Soft bread	20	6.80	299.20	53.83	8.61	1506
Potatoes and onions	16	0.72	73.09	8.60	1.40	340
Dried fruit	3	1.53	50.70	1.77	0.27	220
Sugar	3.5	----	94.25	-----	-----	397
Total	52.5	53.80	517.24	105.88	16.95	3053

Total carbon, 328.76 gm. Nitrogen to carbon, 1:18.

For the following combination the several articles of the ration most closely approaching in character to the food materials used by natives of the tropics, proportioned in quantity according to the standard proposed for hot climates, have been selected.

TROPICAL DIETARY, IV.

Articles.	Quantity, oz.	Fats, gm.	Carbohydrates, gm.	Protein, gm.	Nitrogen, gm.	Fuel Value, calories.
Fresh fish, cod, whole	14	0.79	-----	31.73	5.07	120
Soft bread	20	6.80	299.20	53.83	8.61	1506
Rice	4	0.45	88.87	6.75	1.40	407
Potatoes and tomatoes	16	0.54	65.80	8.17	1.36	297
Dried fruit	3	1.53	50.70	1.77	0.27	220
Sugar	3.5	----	94.25	-----	-----	341
Total	64.5	10.11	598.82	104.25	16.71	2947

Total carbon, 327.50 gm. Nitrogen to carbon, 1:19.6.

On averaging these four dietaries, as furnished by the ration proposed for the tropics, the mean nutrient composition is seen to be as follows:

Dietary.	Quantity in ounces.	Fats, gm.	Carbohydrates, gm.	Protein. gm.	Nitrogen gm.	Fuel value Calories.
No. 1	52.9	53.55	630.39	123.19	18.78	3,677
No. 2	32.9	114.44	556.94	105.69	16.92	3,825
No. 3	52.5	53.80	517.24	105.88	16.95	3,053
No. 4	64.5	10.11	598.82	104.25	16.71	2,947
Average	50.7	57.97	560.85	109.06	17.34	3,375

Total carbon, 350.00 gm. Nitrogen to carbon, 1:20.

It will be observed that while the above dietaries differ considerably among themselves, yet when averaged together in equal proportions, they do not greatly vary from the nutritive standard for the tropics already proposed, and this is an additional reason why a selection of the same articles of the ration should not be made from day to day. It is seen that the above average dietary, as compared with the proposed nutrient standard, is still slightly deficient in fats and fuel value and a trifle in excess as regards protein. These defects, if they may be considered as such, are, however, readily corrected by a rotation of dietaries, in which dietary II is used twice where dietaries I, III and IV are each employed but once. The results of this change are as follows:

Dietary.	Quantity in ounces.	Fats, gm.	Carbo-hydrates, gm.	Protein, gm.	Nitrogen gm.	Fuel value, Calories.
No. 1	52.9	53.55	630.39	123.19	18.78	3,677
No. 2	32.9	114.44	556.94	105.69	16.92	3,825
No. 2	32.9	114.44	556.94	105.69	16.92	3,825
No. 3	52.5	53.80	517.24	105.88	16.95	3,053
No. 4	64.5	10.11	598.92	104.25	16.71	2,947
Average	47.1	69.43	572.06	108.38	17.26	3,465

Total carbon, 363.33 gm. Nitrogen to carbon, 1:21.

From the above tables, it is evident that such changes as are advisable in the adaptation of the United States Army ration to tropical conditions, are chiefly in the line of a reduction in quantity of the foods at present provided by a too generous Government. It is true that the sugars and starches should be slightly augmented, but their increase is small when compared with the considerable reduction of nitrogenous and fatty material which is proposed. Many of the components of the present ration, as is seen by the following table, require no change in the consideration of the tropical dietary, being not only admirably selected, but also properly proportioned.

The ideal ration for an Army of United States soldiers on duty in the tropics is therefore suggested as being of the following nutrient composition, the soap and candle, seasoning and coffee components requiring no change in quantity from their present authorized allowance:

Articles.	Quantity per ration, (ounces).	Protein, gm.	Nitrogen, gm.	Fat, gm.	Carbo-hydrates, gm.	Fuel Value, Calories.
Fresh beef (quarters)	10.0	41.68	6.67	44.75	------	590
or fresh mutton	10.0	46.20	7.35	62.90	------	720
or pork	6.0	27.54	4.40	112.54	------	1093
or bacon	6.0	15.64	2.49	105.06	------	1042
or salt beef	10.0	40.27	6.44	64.68	------	688
or dried fish (cod)	10.0	45.37	7.26	1.13	------	197
or fresh fish, average (whole)	14.0	31.73	5.07	0.79	------	120
Flour	18.0	55.08	7.90	5.60	380.46	1850
or soft bread	20.0	53.83	8.61	6.80	299.20	1506
or hard bread	18.0	73.12	11.74	6.63	371.81	1926
or corn meal	20.0	50.40	7.99	12.40	425.80	1986
Beans	2.4	15.16	2.42	1.22	40.18	240
or peas	2.4	16.38	2.62	0.75	41.80	246
or rice	4.0	8.75	1.40	0.45	88.87	407
or hominy	4.0	9.20	1.47	0.67	88.75	430
Potatoes	16.0	9.50	1.52	0.45	81.70	380
or potatoes, 80% and onions, 20%	16.0	8.60	1.40	0.72	73.09	340
or potatoes, 70%, and canned tomatoes, 30%	16.0	8.16	1.30	0.58	62.59	297
Dried fruit (average)	3.0	1.77	0.27	1.53	33.80	220
Sugar	3.5	-----	-----	-----	94.25	397
or molasses	1 gill	-----	-----	-----	56.05	269
or cane syrup	1 gill	-----	-----	-----	56.25	269

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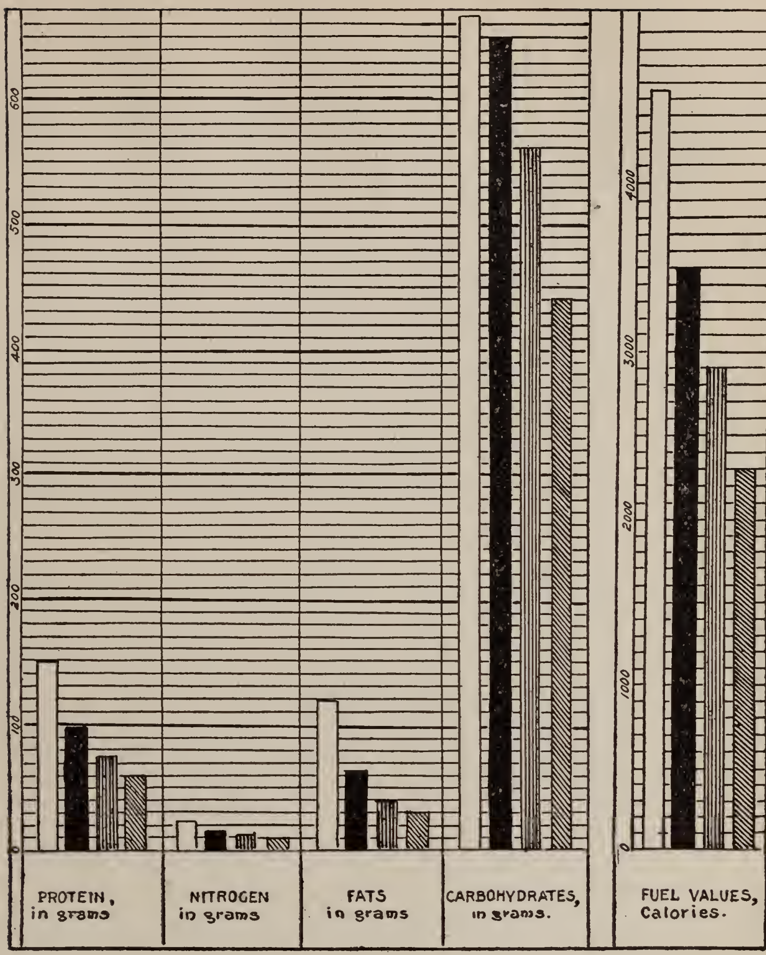


Standard dietary as given by typical dietaries of men at hard labor in the northern portion of the temperate zone.

Standard dietary as given by proposed U. S. Army ration for tropical service.

Standard dietary for native laborers in the tropics; based on the weight of 145 lbs. for purposes of comparison.

Standard dietary of the laboring class of natives in the tropics (Java, British India, Guadeloupe, Abyssinia), as determined from the food actually consumed by them at normal body weights.

XXVI. A PLAN FOR THE ORGANIZATION OF A MEDICAL DEPARTMENT FOR WAR SERVICE IN A UNITED STATES VOLUNTEER ARMY, CONSISTING OF THREE ARMY CORPS OF 42,000 MEN EACH.

In Which is Considered the Formation of a Medical Staff, a Hospital Corps, Ambulance Trains, Ambulance Companies, a Field, Railway, and Water System of Transportation for the Sick and Wounded and their Supplies; its Field and General Hospitals; a System of Medical and Subsistence Supply; its Records, Etc.

BY

LIEUT.-COL. B. F. POPE,

DEPUTY SURGEON GENERAL, U. S. A., LATE CHIEF SURGEON U. S. V., AND OF THE FIFTH ARMY CORPS.

Introductory.

During the winter of 1897-1898 the writer prepared an essay similar to this paper which, in the month of March, 1898, was read before the Officers' Lyceum at Columbus Barracks, Ohio, and which was later published without proper revision in the *National Medical Review,* Washington, D. C.

Since then the war with Spain has come and gone, and now the Philippine War is being waged. From several sources I have been asked to embody in a new paper the results of our later experience in military medical organization and administration, with a view to their record in a permanent form for the guidance of those who are to come after us. Although for thirty-three years I have been a commissioned officer of the Army, I cannot forget that I began my service during the great Civil War as Assistant Surgeon of a volunteer regiment, or that more than thirty years later I had the honor to again serve in the Spanish War under a volunteer commission as Chief Surgeon of the Fifth Army Corps.

For these reasons I am therefore in full sympathy with the American volunteers and recognize the fact that they will be the main arm of defense and offense of the Nation in all its great wars.

To educate them before they are called upon for service, and when the time comes, to place them in the field with the least loss of time or impairment of military efficiency from dis-

eases which are, very largely, the result of preventable causes, is a problem for much study on all lines, but particularly on the part of those who aim to be the medical officers of volunteers or regulars, on whom a great burden of responsibility will always rest. To these gentlemen, therefore, these lessons which are the result of a wide experience and long service are respectfully dedicated. B. F. POPE.

San Francisco, Cal., May 15, 1900.

I. ORGANIZATION.

My subject requires the consideration of the organization of a medical department for an army consisting of three army corps of about 42,000 men each or 126,000 in all, drawn from the civil population of one or more States of this Union and be known as a U. S. Volunteer Army, which in time of war shall supplement the regular forces of the country. The State troops and the National Guards already organized and armed will be excluded from the problem, for the reason that their service will be at once required to hold, in connection with the regular forces, the first line of defense, consisting of such stragetic points within or without the United States as require immediate occupancy.

It is further assumed that this new military force will be raised in the shortest possible time, three months being the maximum limit alloted for that purpose.

The force to be raised will undoubtedly be designated by proclamation from the President of the United States and it will be assumed in this discussion that 126,000 officers and men will be alloted to the military district of ——————.

The scheme of organization as promulgated by the War Department will comprise the formation of this volunteer army into three army corps of approximately 42,000 men each; two army corps being active and the third held as a reserve, from which the former will draw their re-enforcements.

It is assumed that on promulgation of the general order designating the officer who shall organize and command the new army, the Secretary of War will, in nominating the general staff of the Commanding General, also designate a chief medical officer of that army, who shall be a regular officer, bearing the rank of Colonel and Assistant Surgeon-General in the Medical Department. In the later formation of army corps, a simultaneous designation of a chief surgeon will be made, and also in

the formation of divisions. These will preferably be officers of the Medical Department of the Army, bearing the rank of Lieutenant-Colonel and Deputy Surgeon-General and Major and Surgeon respectively. As they will be administrative officers exclusively and not merely professional attendants upon the General Commanding and his staff, it will be necessary that they shall have been previously trained in the special work set before them and become neuclei around which the whole medico-military elements shall group.

The staff of the Chief Medical Officer of the Army will consist of a Major of the Medical Department, who will act as his executive officer, and an Adjutant with the rank of Captain. The Chief of the Army Corps will have a Captain as his assistant, the Chief of Division a First Lieutenant, and the Chief of Brigade also a Lieutenant. The number of stewards and privates of the Hospital Corps acting as clerks and messengers will in each case be regulated by his order.

RECRUITMENT.

Immediately on reporting to the Commanding General for duty, the Chief Medical Officer of the Army of ———— will consult with the Secretary of the State Board of Health and the Board of Medical Examiners with a view to the selection of at least 150 or more physicians and surgeons residing in the military district who might accept a temporary contract with the Surgeon-General of the United States Army, to render their professional services as examiners of recruits, etc., during the organization of the new force. These gentlemen should be fully qualified to perform such duties either by similar service during or since the Civil War and the late war with Spain or through experience as medical examiners of pension claimants or examiners for reputable life insurance companies. The list of candidates having been carefully revised by the Chief Medical Officer and their contracts so worded as to provide for the utmost freedom in the movement and location of the medical examiners, they will be at once sworn into the service of the United States and, under the immediate supervision of the chief medical officers of the several army corps, assigned to duty at points of original enrollment of recruits. It is imperative that the medical examiners shall be under the exclusive control of the United States Army Medical Department, acting wholly for the interests of the United States, and subject to the rules and articles of war and such orders and regulations as may be issued by the War Department. The State authorities shall have no jurisdiction over them. In fixing the number of medical examiners at 150

it is estimated that the whole force of 126,000 men will be examined and enrolled within three months, or about seventy working days. To get so large a number of acceptable recruits, even with a low standard of qualifications, at least 250,000 men must submit themselves for inspection. As the number of rejections for the regular army averages over 75 per cent. of all those presenting themselves, there will be at least 25 per cent. of rejections under the most favorable conditions.

It is necessary that the inspection at local stations be most carefully made, in order to lessen the expense of transportation of the physically unfit to the larger recruiting depots which will be formed, where the recruits must again be examined and possibly rejected on account of concealed defects or general inaptitude for severe field service.

For these reasons it will be seen that at least 176,000 cases must be passed upon, an average of about 2,500 a day, or 17 for each examiner, which is found to be about as many as a careful man can examine and complete the records now required.

THE WORK OF THE MEDICAL EXAMINERS.

It is assumed that the Chief Quartermaster of the Army will cause suitable rooms to be provided for the reception and examination of the recruits, also that the Adjutant-General and the Surgeon-General will forward to the several places of enrollment all requisite blanks and instructions with the necessary scales for weighing the candidate, measuring rods, tapes, tests for vision, bathing facilities, etc.

The Chief Surgeons of corps and divisions will visit all stations to see that they are properly equipped and that the examiners thoroughly understand their duties.

Every person presented for enrollment will be carefully inspected by the medical examiners according to instructions received, and he will reject peremptorily all candidates exhibiting positive disqualification for service.

It is recognized in this discussion that the pressing exigencies of an impending war, or perhaps a war already begun, will require that the physical qualifications shall be made lower than in the case of recruits for the regular army in time of peace.

For this reason the examiners will be instructed to accept for enlistment men presenting moderate departures from the standards of height, weight, chest measure and chest mobility, since it is a matter of experience that from ten to thirty pounds may be gained in the weight of recruits during their first months of service, while chest mobility is often marvelously increased by proper instruction and practice, the tape-measure being by no

means a thoroughly reliable test of absolute respiratory capacity. He will also accept men with lower grades of visual defect in the left eye, the right being normal; minor degrees of ametropia which can be corrected by glasses, in both cases, however, being satisfied that the defects are not due to ocular disease, and with moderate deafness of one ear, the other being normal, and disease of the organs being absent. Slight varicocele need not be a cause for rejection when the scrotum is neither elongated nor the veins much enlarged, neither should slight varicosities of the lower limb reject so long as there are no evidences of varicose ulcers nor swelling of the ankle or foot on constriction of the upper veins. Applicants with moderate anterior curvature of the spine, with a certain amount of flatness of the chest, where it is of good capacity, or with flatness of the feet may be accepted.

It should, however, be insisted on that all these departures from the standard be carefully noted on the examination blanks or other forms of record that they may be preserved for future consideration in connection with the adjustment of claims for pension that are sure to arise.

It should be borne in mind by the examiners that men desiring enlistment will minimize or conceal defects which later may be urged as reasons for evasion of duty or for discharge on surgeon's certificate of disability when the service becomes distasteful, and later be made the basis of a claim for pension, particularly since recent legislation looks towards the acceptance of recruits as a waiver on the part of the government of all disabilities found after enlistment, whether they existed before entry into the service or not.

Defects most liable to be concealed are impaired vision of the left eye, the right being normal; the loss of upper and lower molar teeth, which will necessarily interfere with the proper mastication of food, and the subsequent appearance of digestive disorders dependant upon that condition; concealed hernias that have been temporarily supported by a truss, discarded or hidden during examination; stiffness of the joints of the fingers; overriding toes; hammer toes; corns on the bottoms of the feet; flat foot and tight phymosis.

Vaccinations.—Immediately upon the acceptance of the recruit he will be vaccinated by the examiner. The operation should be done with aseptic precautions from virus furnished by the Surgeon-General's office through the Chief Surgeon of the corps or division. A record of this vaccination will be made upon the descriptive and assignment card. See pars. 843-846, A. R., and pars. 90, 125, 127, Manual for the Medical Department, U. S. Army.

II. Personnel of the Regimental Medical Service.

The organization of the medical service for the new regiments will, without doubt, proceed as during the War of the Rebellion and the late war with Spain. The Governors of the States, where State volunteers are enrolled, and the President, when U. S. volunteers are being raised, will appoint and commission the several regimental medical officers, providing each full regiment with one surgeon with the rank of Major, one assistant surgeon with the rank of Captain, two assistant surgeons with the rank of First Lieutenant, one hospital steward, three acting hospital stewards and fifty-two privates for the hospital corps.

The appointment of the medical staff should keep pace with the building up of the regiment; commencing with officers of the lower grades, assigning an Assistant Surgeon to an organization of one battalion, a Captain and Assistant Surgeon to two battalions, one First Lieutenant and Assistant Surgeon for the third battalion and one Major and Surgeon when the regiment is completed.

The non-commissioned medical staff is to be organized in a similar manner, namely, one acting hospital steward for one battalion, a second acting hospital steward for two battalions, a third for three battalions, together with a full hospital steward for an entire regiment. The number of privates of the hospital corps will be at least four for each company and band, or fifty-two in all. To every battery of light artillery one Assistant Surgeon will be assigned and with him one acting hospital steward and eight privates.

The complement of the medical staff of a regiment of cavalry will be the same as that for an infantry regiment.

With the formation of brigades and divisions, chief medical officers will be appointed to these organizations.

EXAMINATION OF REGIMENTAL MEDICAL OFFICERS.

It is assumed that the pressure for time will be so great that for original appointments in the lower grades of office it will be necessary to waive examinations, relying for qualifications upon the degrees held by the applicants and their general reputation for personal efficiency and professional skill. In every case, however, they should be subjected to a rigid physical examination with a view of determining their ability to withstand hard service in the field with troops, and all those not found physically fit should fail of appointment.

For the higher grades of office a closer inquiry should be made as to the qualifications of applicants by means of examining boards, and where possible they should be filled by promotion from the lower grades, after due examination, in accordance with the regulations of the U. S. Army Medical Department.

In all such cases the custom of seniority must be disregarded and only those exhibiting in their short probationary service particular aptitude in administrative as well as professional work should be recommended to appear before the examining board. Good personal habits and efficiency are to be of the first importance in each instance.

For the later and higher grades of office seniority combined with acceptability should be the rule of promotion.

UNITED STATES VOLUNTEER MEDICAL STAFF.

The formation of a United States Volunteer Army medical staff will come next in order. This will comprise as many surgeons and assistant surgeons as may be required to fully equip the various hospitals that must be organized, without making drafts from the medical officers of regiments, a practice which results in depriving many commands of their complement of medical attendants and crippling the service to an alarming extent.

The functions of the hospital surgeons and regimental surgeons should be separate and distinct and any detail from his command should rarely be sought by a conscientious medical officer or permitted by his superior.

The selection of these volunteer medical officers should be from the best attainable professional talent of the military district, or of the country, the lower grades of office being filled first, and promotion after examination as to both military record and professional attainments being employed to fill the higher grades of office.

They should all be commissioned by the President under the several grades of First Lieutenant, Captain and Major, of the same date if practicable, the order of precedence being arranged by the Surgeon-General of the Army on recommendation of the Medical Examining Board, two-thirds of whose officers should at first be taken from the U. S. Army Medical Department.

Assignments of the U. S. Volunteer Medical Staff.—These will be made to brigade, division and army corps field hospitals and general hospitals, as will be set forth under the following subheadings. They will also be assigned as attending surgeons at headquarters of the Army in the cities and towns where their

services may be needed, at camps of recruitment and instruction, at camps of convalescents, with large supply trains, hospital trains, ships, large quartermaster and subsistence depots, Army transport ships, railway trains bearing recruits, horse ambulance trains, bearer companies or on any other special service that may be required of a medical officer not attached to a military command.

CONTRACT SURGEONS.

During both the Civil War, the war with Spain and the present war in the Philippine Islands, a large number of medical gentlemen have been employed to render their professional services to our troops in the field in their camps and in the hospitals. These gentlemen have represented every grade of professional attainment from the highest to the lowest, yet on the whole, so far as their professional work has been concerned, I believe that their services have proved satisfactory. In fact, it must be admitted that by far the greater part of the medical attendance to the sick and wounded during these wars has been in their hands. That they have faithfully and skillfully performed their work is shown by the following statistics, which are taken from the report of the Surgeon-General of the Army for the year ending June 3, 1899:

The total number of admissions to sick report during the year was 100,123, with 1,285 deaths, the ratio being 1.28 per cent.; the ratio of deaths from injuries to the number of cases treated was 2.65 per cent.; the ratio of deaths to the number of cases of disease treated was 1.13 per cent. Taking the more serious types of disease, such as typhoid fever, the death rate was 10 per cent.; that from malarial fever, 0.46 per cent., and from diarrheal diseases, 0.70 per cent. For gunshot wounds the rate of deaths to cases was 6.65 per cent.

Considering the arduous nature of the services rendered by our troops during the past two years, the deadly character of the climate and diseases to which they have been subjected, the difficulties that have surrounded the treatment of the sick and the injured in tropical regions, the foregoing exhibit is remarkable, and will contrast favorably with that of any army medical department in the world.

The experience of the past, however, has shown that for administrative duties, upon which the successful work of the Medical Department depends, the enforcement of sanitary regulations, the control and discipline of non-commissioned officers and enlisted men, whether as patients or members of the hospital corps; the preparation of reports; the procurement of

medical, quartermaster and subsistence supplies; the care of public property, the rendition of required returns for the same, and the disbursement of and accountability for public funds, etc., there is much that is lacking in this class of public officials.

Again, the military status of a physician under contract is most unsatisfactory both to himself and the persons with whom he is necessarily associated. Officially, he is neither fish, flesh nor fowl. His pay of $150 per month is never raised, no matter how valuable nor how long his services may have been and he has no hope of present promotion, or of pension in the future.

If disabled by wounds or disease in the service of the Government and thereby prevented from performing his accustomed duties, his pay may be stopped by direction of the autocratic Auditor of the War Department. He is not entitled to a leave of absence, as are other men serving at his side, and who have been in no greater peril of life or limb. Indeed, beyond all other men, I consider him a most self-sacrificing and patriotic citizen of the republic, who gets less credit for his work than any one other person occupying a position of equal responsibility.

Perhaps a few contract surgeons might be required to tide over an emergency, but to depend on them as a part of our military forces, either regular or volunteer, in peace or war, I think a mistake. All their professional services can be as well performed by commissioned officers and many other important functions filled that are now only half filled.

MEDICAL INSPECTORS AND INSPECTIONS.

Medical officers attached to battalions will make a daily inspection of the same, according to existing regulations, reporting to the senior surgeon any irregularities they may discover which would affect the health of the command. The senior surgeon will personally verify such report and forward it to the regimental adjutant, with his recommendations in the case.

Chief Surgeons of Brigades will keep a roster of the senior regimental surgeons, and from them will make a daily detail of a medical inspector, who shall visit all the camps of the troops composing the brigade, and at the end of his tour report the sanitary condition, and the efficiency of their medical service. He will also inspect the brigade ambulances, see that wagons are properly fitted with litters, surgical supplies and emergency foods for the sick and wounded, that the animals and harness are in good order and that the hospital corps men, including the drivers, understand their duties.

The senior medical officer of the regiment will accompany the brigade inspector in his tour of the regimental camp and

hospital, and will call his attention to any matters of defective sanitary, police, or water or food supply or disposal of excreta and camp refuse that may exist.

The Chief Surgeon of Division will, from time to time, as he may deem proper, detail and require one of the brigade surgeons to act as his inspector in any special case or to examine particular defects of medical administration reported as existing within the division, and submit his report for the information of the Division Commander, through the Chief Surgeon and the Adjutant-General of Division.

In the same manner the Chief Medical Officer of an Army Corps will require a Chief Surgeon of Division to act as his inspector in any required matter relating to the medical department of the Army Corps.

All of these inspections may be supplemented by a Special Medical Inspector appointed by the Chief Surgeon of the Army or by the Surgeon-General.

III. THE HOSPITAL CORPS.

Without going into a history of the formation of our hospital corps during the late war with Spain, it may be briefly stated that the ultimate result of executive orders and national legislation during the year 1898-9 was to provide a corps of 6,588 men as a maximum for war service, being about 2.60 per cent. of the total number of troops raised. Subsequently, through the discharge of volunteers and other causes, the number was reduced to 3,368 men. Under the act of March 3, 1899, which authorized an increase of the regular army to 65,000, a decision by the Adjutant-General was published March 9, 1899, fixing the total at 2,600 men, or about 4 per cent. of the strength of the force.

Later, under a combined decision of the Judge Advocate-General and Adjutant-General of the Army and the Comptroller of the Treasury, it was held that the hospital corps was not included in the 65,000 men. This decision removed the limitation as to the number of acting hospital stewards and privates, but not of hospital stewards, these remaining at 100.

The mean strength of the Medical Department up to December, 1898, was 3,738, that for the Army being 46,635, or about 8 per cent. of the regular force, or 1.50 per cent. of the volunteers and regulars combined.

The plan of discretionary enlargement of the hospital corps, permitting the Secretary of War to increase its number to the needs of the Army, is unquestionably a good one, for there should

be no limitation so long as the proper care of the sick and wounded demands such increase, either during war or in peace.

For the purpose of this paper, therefore, I have assumed that a number equal to at least 4 per cent. of the strength of the command should be attached to the Medical Department as stewards, acting stewards and privates of the hospital corps, to be organized as follows: First as

AMBULANCE COMPANIES.

The number of these companies should be as follows:

For three divisions, three companies of sixty men each, or a total of 180 men. In case of necessity the companies can be increased to 104 men each.

For the army corps in reserve, two companies, or 120 men.

For the corps ambulance trains, one company, or sixty men.

Total for the army corps, six companies.

For the army corps which is held in reserve, five companies, or 300 men.

Total for the army, seventeen companies, or 1,020 men.

All of these are to be supplementary to the regimental hospital corps men and do not include the detachments forming the personnel of the field and general hospitals.

The organization of the companies will be from the volunteers exclusively, and will not be a part of the regular army. They will be commanded by medical officers of volunteers, duly commissioned, and they will, as a battalion or as separate companies, be under the immediate orders of a Major and Surgeon of the Regular Army and the Chief Medical Officer of the Army Corps.

They will, unless otherwise directed, be camped near the Army Corps headquarters, and assigned only to such divisions or parts of the Army Corps as the Chief Surgeon may direct.

Each company will consist of one Captain and Assistant Surgeon of volunteers, two First Lieutenants of the same, one hospital steward, who shall be the first sergeant of the company; three acting hospital stewards, who shall be designated as sergeants and receive five dollars per month of additional pay while on that service; eight acting hospital stewards, who shall be designated corporals, and forty-seven privates of the hospital corps, one of whom shall act as a cook and two as buglers.

Equipment.—To every medical officer, one emergency medicine case; for the company, one surgeon's field operating case, which shall be in charge of the hospital steward; to the three hospital corps sergeants, one medical officer's orderly pouch each;

to the hospital corps corporals and privates, one hospital corps pouch each, also a first-aid packet belt of approved pattern. The cooks and buglers will be without pouches, but will carry the belts. To every company there will be eleven litters. Every enlisted man will have his blanket, shelter tent half, haversack complete, canteen and tin cup. His spare clothing will be carried on the company wagons, neatly rolled in an extra shelter half. Eight spare litters will be carried on the company wagons, two strapped to each side of the wagon body, to replace those that will be broken in use.

Every commissioned officer and hospital corps sergeant will be mounted and, with mounted commands, all the enlisted men will be mounted.

Each officer will be attended by a mounted orderly when so directed by the Chief Medical Officer of the Corps (see par. 1421, Army Regulations).

Two six-mule wagons should be assigned to each ambulance company, and one water cart. This cart will be furnished with two mules when the condition of the roads require such service.

The wagons will be equipped as follows: Two "Buzzacott" ovens, one large and one small; eight camp kettles; two hospital-mess chests; two wall tents complete with flies, and one large Sibley tent for the hospital corps sergeant. G. O., No. 76, of June 22, 1898, provides two common tents for non-commissioned officers and seventeen common tents for the privates; one large water keg for each wagon; two spare wagon tongues and two sets spare whiffletrees; two monkey wrenches; six axes; six spades; two water buckets; one box extra tent pins and guy ropes; two cross-cut saws; one hatchet for every litter squad or eleven in all, together with five days' rations for the men and three days' forage for the animals. The wagons and carts will be driven by quartermaster employees, who understand the care of animals. Each wagon shall also have a box of 500 first-aid packets, placed so that it shall be easily accessible at all times.

Formation and Instruction of Ambulance Companies.—Immediately on the receipt of orders for the organization of an ambulance company, the designated commander thereof will supply himself with two copies of the U. S. Army Regulations, two copies of the Manual of the Medical Department, fifteen copies of the Drill Regulations for the hospital corps and three copies "Hand-Book for Hospital Corps," by Smart, a set of company record books and blanks as required by pars. 243-244, A. R.; muster and pay blanks, etc., all of which can be procured on application to the Adjutant-General and Surgeon-General of the Army. One copy of the Regulations will be retained, the other

given to the first sergeant for use in the company. The Manuals will be distributed to the commissioned and warrant officers for the instruction of themselves and the men.

Clothing.—The commander will at once prepare proper estimates and requisitions for clothing, blanks for which will be furnished by the Quartermaster. The schedule will enumerate the articles needed by each man and the money value of every article as shown by the last annual clothing order from the A. G. O. (See par. 1164 et seq. and 1178 et seq., A. R.) Canteens, tin cups, haversacks, waist-belts, saddles and harnesses are procured from the Ordnance Department by similar requisition (see par. 1535, A. R.), and there will, without doubt, be an ordnance office of the U. S. Army designated to supply these articles, with the forming army. Wagons, mules, horses, mule harnesses and mule-saddles can be procured from the Quartermaster, also tentage and other camp equipage. Formal requisitions on the regulation blanks approved by the Chief Surgeon of the Army Corps are required in such cases.

The Medical Supply Officer, also on proper requisition approved by the Chief Surgeon of the Corps, will issue medical and surgical cases, hospital corps pouches, litters, mess chests and other medical property needed, always provided he has them on hand. In such cases the regulation medical supply table will be strictly followed (see Manual for the Medical Department, pars. 65-68.)

Food.—The food for the men will be procured by making requisition on the Commissary of Subsistence attached to the depot. Ration returns enumerating the number of men and the articles of the ration required will be sent to the battalion commander for approval, and then taken to the commissary, who will make the issue. (See par. 1258 et seq., A. R.)

The interior economy of the company should be in strict accordance with Army Regulations as prescribed in Article XXXII, pars. 251 to 286, inclusive, which must be carefully studied by the officer commanding.

The instruction of the ambulance companies will commence immediately on the appearance of the first recruits. First in the setting up drill and marchings, as prescribed by the Infantry Drill Regulation, a copy of which should be on hand, and next, in litter drill and first-aid to the injured, etc., which will occupy at least two or three hours each day.

Later, lectures on the requirements of the articles of war and military discipline will be given. Then lectures on personal and camp hygiene; the recognition of the more common forms of infectious and contagious diseases (including venereal disorders);

the purification of water by sterilization and filtration; the preparation of foods for the sick or wounded, from the regular or emergency ration; the erection of tents or improvised shelters; the construction of field cots and litters; the recognition of unhealthy localities; the drainage of damp camping grounds, and search for better ones; the care of public property and animals and many other subjects will occupy all the time that may remain before the troops enter on active campaign.

Muster and Payment of the Company.—At every muster of troops, muster and pay-rolls will be prepared by the commander of the company or separate detachment on blank forms furnished by the Adjutant-General of the Army, according to directions thereon. (See par. 784 et seq., A. R.)

I have been thus explicit and possibly tedious, because it was our sad experience during the late war, and in fact during all our wars, that officers of volunteers and militia and many younger officers of the regular service, through ignorance of the very first principles of military supply and administration, created woful confusion and much distress to our patriotic, but not always patient, fellow-citizens, who took up arms in defense of our common country.

THE FEMALE NURSE CORPS.

A circular from the Surgeon-General's office under date of June 20, 1899, publishes regulations governing this valuable auxilliary to the Army Medical Department, which will no doubt become a permanent institution. * * *

"The nurse corps shall consist of chief nurses, nurses and reserve nurses.

"The Surgeon-General may assign female nurses to duty at all army hospitals where the cases treated are of such character as to require care of trained nurses. Under ordinary conditions not more than two will be assigned to a hospital having less than 20 beds.

"A medical officer requiring the services of female nurses at a hospital will make application to the Surgeon-General through the chief surgeon.

"At each hospital to which nurses are assigned one of them hsall be a chief nurse, appointed by the Surgeon-General.

"Women not under Army contract will not be permitted to serve as nurses in Army hospitals, unless in an unforeseen emergency, and in such cases the medical officer in charge of the hospital will immediately report the fact to the Surgeon-General for action."

* * * * * * *

Then follow regulations as to appointment, qualifications, term of service and annulment of contract, pay, transportation, leave of absence, transfers, quarters, rations, reports and returns, uniform, duties as nurses, duties as dietist, and as chief nurse, etc. The circular quoted also provides for reserve nurses in the following terms:

"A certain number of nurses who have rendered at least four months' satisfactory service in the Army will be appointed reserve nurses.

"Each reserve nurse will sign an agreement to enter active service whenever required and to report by letter to the Surgeon-General on the 1st of January and the 1st of July of each year and at other times if required.

"Reserve nurses wear the badge of the Army nurses, but are not paid except when on duty," and

"When assigned to active duty they will be subject to all established rules and regulations, and will receive the pay and allowances of nurses on the active list." * * *

Desirability of Female Nurses in Military Hospitals.—There seems to be much diversity of opinion among medical officers and patients also in regard to the desirability and adaptability of female nurses to the work required in the Army.

Those whose experience has been limited to civil institutions and the general hospitals of the Army established during and since the late war, speak highly of their services. Those whose experience includes experience in the smaller regulation post or regimental hospitals and in expeditionary work, do not, and as often occurs in such cases, both parties are right from their own points of view.

While the trained female nurse recognizes her own importance, to the fullest extent, sometimes with considerable arrogance, it may be said the hospital corps private who works by her side, at one-half her pay, finds himself becoming simply a carrier of pots and buckets and a general ward scrubber, the professional part of nursing being quite taken out of his hands. All of this breeds discontent, inefficiency and constant quarrels. On the whole, I think that experience will justify us in making the attempt to gradually replace contract female nurses with trained male nurses to a very large extent, who will be civilians under contract at the same rates of pay and allowances. This will open up a future to discharged hospital corps privates who have gone through at least three years of instruction and practical work in army hospitals and are pronounced thoroughly competent by a board of examiners and by the officers under whom they have served.

This plan I think will inspire the present hospital corps private to greater exertion and efficiency than can be expected of him under existing conditions.

Trained male nurses are more to be desired than females: First, because they can better control the men; second, because they can perform all the duties of female nurses equally well and do much besides that women cannot or will not undertake; third, because they can be employed on the field and in exposed positions where no provisions are made for women, and fourth, because they relieve the patients of much embarrassment attending the discharge of natural functions in the presence of women, particularly if they be young and good-looking. The average young American is a bashful man and naturally shrinks from exposures in the presence of ladies, which the more hardened female nurse does not mind. Particularly is this the case when convalescence has so far progressed that the patient can take notice of what is going on about him.

IV. HOSPITALS.

FIELD HOSPITALS.

In time of active campaign the only field hospitals for which adequate transportation can be furnished that will not materially hamper the mobility of marching commands are those of the division and the army corps reserve hospital.

Regimental hospitals were loudly demanded during the forming period of volunteers in the last war, and when military conditions permits they may be allowed, but with the commencement of movements involving the transportation of immense trains of supplies, they soon show their temporary nature and will be abandoned. A regiment must carry its medical staff with it, in which case the regimental sick are either abandoned or sent to base hospitals, where they should have gone at first.

In permanent camps regimental hospitals may be permitted and their outfit will be described later.

The divisional hospital properly administered has been shown by all experience to be the best. To describe one will be to describe all of the four hospitals required for an army corps acting as a unit in the field.

Every divisional hospital should be arranged to accommodate at least 500 sick and wounded men, in its tentage, its supplies, its transportation and its personnel.

The organization of these field hospitals will include their division into three sections, each one of which will be as nearly

independent as possible under a single unit of administration. The tentage, equipment and transportation will be equally divided so that a single section can be unpacked without disturbing the others. Where minor engagements occur or a rapid change of front or movement of a part of a command is anticipated, whether the whole or any part of the hospital may be utilized can be determined by the Chief Surgeon of Division after consultation with the Chief Surgeon of the Corps and the Divisional Commander.

The field hospitals should all be under the control of the Chief Surgeon of the Army Corps, when it is acting as a unit, and not under the control of Chief Surgeons of Divisions or Division Commanders. Cases have occurred where all sick men have been denied admission to such refuges because they belonged to other divisions, or hospitals have been carried away wholly beyond the control of the Chief Medical Officer of the Corps, and for this reason they will be designated as divisional and not division hospitals. The division has no vested rights in them except as a part of the whole or when detached and acting separately from the main body of troops.

DIVISIONAL AND RESERVE CORPS HOSPITALS.

Personnel.—There will be assigned to duty with each divisional field hospital, one Surgeon with the rank of Major, who shall be its administrative head and, if possible, he should be an officer of experience. As assistants he will have a Captain and Assistant Surgeon, also of experience in administrative details for his executive officer, and a First Lieutenant in charge of the hospital mess, medical and subsistence stores, etc.

The professional staff will consist of volunteer surgeons as follows:

Three surgeons as operators, and to each of these at least two assistants, making twelve medical officers in all. There will also be detailed with the hospital, an acting assistant quartermaster, who shall require and receipt for all clothing, tentage, equipage, wheel transportation and public animals assigned to the hospital. He will, under the surgeon in command, have control of the same and keep it at all times in good order.

Enlisted Personnel.—Of enlisted men there will be three hospital stewards, one for each section; six acting stewards and forty-two privates of the Hospital Corps whose duties will be exclusively with the hospital as cooks, nurses and attendants. During active movements in the field there will be no female nurses assigned, but while troops are in camp, details will be

made by the Surgeon-General of the Army as the nature of the cases may demand.

Material of the Field Hospital.—Its tentage will consist of eighty-four hospital tents for the sick and wounded exclusively, each one of which will accommodate six patients; three tents placed end-to-end with flies intervening will constitute a ward. There will be four tents for the dispensary, the operating room and hospital stores, and four tents for kitchen mess tents and subsistence stores. In permanent camp, bath tents, tents for sinks, etc., should be provided. Total for field movements, ninety-two.

There will be wall tents (7) for officers and large conical tents (4) for members of the Hospital Corps. In case of emergency, the Hospital Corps will use their shelter halves, poles and pins. The tent-flies will be packed by themselves with a sufficient number of uprights and ridge poles, pins and guy ropes, so that when needed, shelter can be constructed for an overplus of wounded.

Furniture, Bedding, etc.—With an actively moving command, the field hospital will necessarily be restricted as to the amount of furniture, bedding and supplies that can be transported by wagons; and for this reason the following list will be found to be lacking in several apparent comforts that must be brought to the command as opportunity offers. This particularly applies to furniture, including cots, tables and chairs. If every wounded soldier could be accompanied by his own blanket, shelter-half and rubber poncho when he is brought to the dressing station, the number of hospital blankets could be materially reduced. But it has been my experience that our own soldiers, at least, come to the dressing station and hospital destitute of everything, often of their clothing, so that it becomes necessary to send out wagons and men to the battle field to gather abandoned blankets and kits and bring them to the hospital. While it is expected that the medical department will carry an ample stock of such articles, practically such is not the case as the number of wagons and animals allotted to the hospital train is never sufficient for their transportation.

Bed sacks that can readily be filled with straw or grass, should be packed in bales and taken in the place of mattresses. Pillow sacks and cases should also be supplied which can also be stuffed with straw or leaves or perhaps the clothing of the soldier, if he has any left. The shelter-half will make a serviceable part of the bed, and may also be thrown over the blanket as a rain cover.

A number of pajama suits with drawers and shirts

should be provided for, as I have stated, the soldier's clothing is too often sacrificed, being too badly torn and soiled with blood and dirt ever to be used again.

To make good this loss, extra clothing should be issued by the quartermaster department in bulk to meet just such emergencies, without the formality of individual receipts on clothing schedules, or specific orders in each case, as is required under ordinary circumstances.

In order to still further reduce the impedimenta of the field hospital, all litter bearers bringing patients to the same should see to it that the soldier's haversack and its contents, together with his canteen and other parts of his equipment accompany him, and the bearers should also be instructed to bring in stray articles of that nature found upon the field, to supplement the hospital supply of tableware, bedding, etc.

When patients are forwarded to the base hospital, these articles can be dispensed with and turned over to some designated officer who will account for the same.

At the base or general hospital there should be an abundance of all necessary supplies.

To properly equip the field hospital, however, the following articles of furniture are indispensable:

3 surgical operating tables.
3 tables for dispensary use.
6 common tressel tables for the mess tent, 8 by 3½ feet each.
3 folding desks with stands for the same.
12 folding chairs.
124 cots, if possible to transport the same.
24 folding bedside tables.

The schedule hereto attached will show in detail what will be needed for every hospital.

92 tents, hospital.
92 tents, flies.
184 tent poles, upright.
92 tent poles, ridge.
1,472 tent pins, large.
2,208 tent pins, small.
7 tents, wall.
7 tents, flies.
14 tent poles, upright.
7 tent poles, ridge.
56 tent pins, large.
91 tent pins, small.
30 axes and helves.
30 spades.
30 mattocks and helves.
30 buckets, galvanized iron.
30 hatchets and helves.
3 Buzzacott ovens, small.
3 Buzzacott ovens, large.

All of the above should be procured from the quartermaster department, on requisition approved by the Chief Surgeon.

The following articles should be procured from the medical department also on proper requisition approved by the Chief Surgeon:

500 blankets, gray.
50 blanket cases for packing.
500 blanket ticks or mattresses, if there be sufficient transportation for the same.
500 pillow ticks, or pillows, under the same conditions.
2,000 pillow cases, cotton.
2,000 bed sheets, cotton.
1,000 drawers, cotton.
1,000 shirts, cotton, or
1,000 Pajama Suits.
500 colored quilts.
2,000 towels.
500 plates, tin.
500 cups, tin.
50 basins, tin, wash.
500 spoons.
500 knives.
500 forks.
3 mess chests, complete.
48 lanterns.
48 doz. lamp wicks for same.
3 coal oil stoves, blue flame.
3 surgical operating tables and the following property, if transportation can be provided for the same:
124 folding cots, canvas covered.
124 mosquito bars.
24 commode chests.
24 bedside tables, folding.
48 close stools.
24 chairs, folding.
6 common tressel tables, 8 x 3½ feet.
3 field desks.
3 desk tables, folding.
3 folding arm chairs.

The surgical instruments and medical supplies for the hospital will be according to the supply list issued by the Surgeon-General at the time. They will be drawn from the Medical Supply Officer, who shall maintain a depot near the Army Corps headquarters, on requisitions approved by the Chief Surgeon of the Corps.

The surgeon in command of the divisional hospital must make timely requisition for all he will need to replenish his stock of medicines and hospital stores, five days' supply in advance of current needs being always maintained in the medicine wagons.

Subsistence Stores.—The food supply will be drawn from the commissary department, partly by requisition and partly by purchase. The ration is for the members of the Hospital Corps, the civilian nurses and the convalescents. The return blank, which can be obtained from the subsistence officer, will enumerate the number of persons for whom the rations are drawn, the number of days it covers and the various articles required. Usually five days' supply for the total personnel of the hospital staff will be ordered.

Extra Articles of Diet.—From the rations drawn by the hospital, through economy in their cooking and handling, savings can be made, principally in pork, bacon, dried fish, coffee, tea, flour and rice, which being sold to the commissary under authority of the regulations, will admit of the purchase of extra articles, such as eggs, butter, milk, fruit, etc. The usual amount saved is from 2.50 to 4.50 cents per ration. The savings account is furnished by the subsistence officer to the Surgeon, who will take up on his own account the money value of the savings, and ex-

pend the same under the regulations of the War Department and the Surgeon-General's office. (See pars. 300, 1,269, 1,448, A. R., and pars. 55, 56, et seq., Manual of Medical Department.) The above is known as *the Hospital Fund* account and is rendered monthly to the Surgeon-General through the Chief Surgeon of the Department or Army Corps.

For the sick who are unable to use the components of the ration, an allowance is now made under the provisions of General Orders No. 182, Headquarters of the Army, A. G. O., October 20, 1899, by the commissary department in the following terms:

* * * The medical officer in charge of a general, post or camp hospital, or hospital ship or transport carrying patients, is authorized to purchase, under the laws and regulations relating to purchases of subsistence stores, such articles of food, both solid and liquid, not carried in stock by the subsistence officer, who issues rations to the hospital, and to call upon such subsistence officer for the issue of such quantities of articles from the stock already on hand as, in the judgment of the medical officer, are required for the diet of enlisted patients under his charge, who are too sick to be subsisted on the ration as ordinarily issued, the total combined money value of the stores hereby authorized to be purchased and issued as above in any month, not to exceed the rate calculated on the month's transaction of forty cents per man per day for those actually requiring special diet.

Subsistence officers are authorized to pay all duly certified bills of purchases made by medical officers under the provisions of this order, or to make purchases themselves at the request of the medical officers * * * provided the rate of forty cents * * * is not exceeded in any month.

Experience has shown that in hospitals caring for over fifty patients daily this sum is ample.

The subsistence department furnishes an admirable field bakery, made of rolled iron sheets, three-sixteenths of an inch in thickness, which, with its other appliances, will supply an excellent quality of fresh bread to field hospitals. It is simple in its construction and management, and can be easily taken apart for packing in a wagon. A field coffee roaster is also furnished by this department. (See pages 225 to 241 Manual for Army Cooks, 1896, by Commissary-General's Office.)

Heating Apparatus for Field Hospitals.—In winter every three tents which go to form a hospital ward will have a large Sibley stove and a proper amount of piping. If stoves cannot be obtained, trenches will be dug beneath each ward two feet wide, two feet deep and about forty-five feet long, covered with iron plates, flat stones or railway iron well covered with clay

or mud. At one end of the trench a chimney will be built of mud and stones or of sods; at the other end, a large opening will be made for a fire box. The draft is regulated by iron plates or flat rocks placed in front of the opening.

With the apparatus described a series of tents can be made very comfortable in winter, as I can testify from personal experience, in using the same. Where fuel is plentiful, open fireplaces may be constructed which will give better ventilation but less heat.

Ventilation of Tents.—Summer ventilation in fair weather is not a difficult problem, but when storms occur and during cool weather, it becomes more difficult. Perhaps the most successful attempt to meet this indication has been made by Captain E. L. Munson, Assistant Surgeon, U. S. Army. This method requires, however, a peculiarly constructed tent recently adopted by the board of equipment for the military service. This tent is described and figured in the annual report of the Surgeon General of the Army for the year 1899, page 230, and I quote briefly from the same. Captain Munson says: * * * "After some consideration the writer suggests the following changes in the regulation hospital tent, which it was believed would materially improve the latter for service in the torrid zone.

"1. That the present tent fly be enlarged two feet in length and four feet in width.

"2. That this fly be raised upon a light false ridge, placed one foot above the true ridge and projecting two feet to the front and rear. This is accomplished by lengthening the present pole pins by one foot, and providing two suitable metal-lined sockets in the false ridge for their reception. This false ridge is provided with a short pin on the upper aspect of each extremity to keep the canvas in position, while, to facilitate transportation, this false ridge is divided obliquely in the center and inclosed in a galvanized iron box to form the joint.

"3. That the canvas comprising the top of the tent be cut out for a space of two feet wide on each side of the ridge, and running the entire length of the tent, except one foot front and rear. The canvas thus removed is replaced by heavy rope netting, having a mesh about two inches square.

"4. That the tent fly be white in color, to better reflect the heat rays, while the tent itself is drab, to render the light in the interior properly subdued. * * *

"The portability of the new tent is the same as the old style tent, since the long false ridge is made in two parts to facilitate transportation. * * *

"During cold weather it may readily be made as snug as

the old tent by merely placing an ordinary fly over the true ridge under the false ridge and a large fly, and pegging it down, so that the smaller fly will lie against the tent roof and thus close the large ventilating opening." * * *

Reference to Captain Munson's article is specially invited.

Arrangement of Tents for a Field Hospital.—In the arrangement of tents for a field hospital there are several things to be considered:

1. The selection of a ground that is free from subsoil water; is clear of rubbish and filth; that has not been used before for camping purposes; that has a gentle slope to admit of drainage during wet weather; that is near to a good supply of running water, either spring or rivers; is accessible to main roads but not too near them, etc.

2. The economy of administration. If tents are placed side by side, a larger number of nurses will be required to properly care for the sick and wounded than can be supplied. The attendants will be exposed to all weathers and must tramp through the mud in going from tent to tent, and in cold weather it is impossible to warm the tents satisfactorily. The advantages are good ventilation and isolation of serious cases.

If tents are arranged end-to-end, ventilation is less effective, but one nurse can take care of a greater number of patients and can have constant supervision over them.

Arranged in radiating lines—in the form of a cross—the center being covered with tent flies, there is combined economy of space and centralization of supervision with desirable isolation, but the ground must be of a peculiar formation to prevent the draining from one tent into another and this is often difficult to find. This plan is favored by Captain James E. Pilcher, Assistant Surgeon U. S. Army, and was quite extensively used in the Seventh Army Corps during the last war. Captain Munson, in his article, states that when several of his improved tents are pitched together to form a hospital ward, a continuous roof may be formed by the large flies, while the tents themselves are located four feet apart, thus dividing the ward into tent-sections, permitting free lateral ventilation; allowing entrance to each tent without passing through the other tents; permitting the ready isolation of any section, etc. This plan meets my personal favor and on the whole, seems to be the best yet devised.

ARMY CORPS RESERVE HOSPITALS.

The Army Corps Hospital will form a reserve for the reenforcement of the divisional hospitals. Its personnel and equipment, its tentage, supplies and transportation will be the same

as that of a divisional hospital. It will be under the control of the Chief Surgeon of the Corps.

In addition to its fixed personnel, there will be attached two companies of the Hospital Corps, organized, officered and equipped as already described. In no sense will it be utilized as a general hospital for the prolonged retention of patients nor will it lose its mobile character.

In case of an engagement with the enemy, the Chief Medical Officer of the Army Corps will ordinarily determine the location of the several field hospitals; when they shall be united at the point of greatest pressure, or separated equally along the line; whether they shall be unpacked as a whole or in part, etc.; the controlling idea being to provide, with the greatest elasticity and freedom of movement, the most complete readiness for abrupt changes of base, consistent with proper care of all the sick and wounded that may be brought from the front.

When a greater accumulation of wounded occurs than can be properly handled by the permanent staff of the field hospitals, the Chief Surgeon of Division will, according to direction from the Chief Surgeon of the Corps or on his own volition, detail certain regimental medical officers as operators and assistants to report to the surgeons in charge of the field hospitals, or to the ambulance dressing stations, with their field equipments of medical and surgical supplies, to render such aid as may be temporarily needed. When the stress is over, or their commands are about to march, these officers will return to their stations.

A roster of operators should be prepared by the division surgeons in advance, so that the officers concerned may at all times be prepared to respond to the summons, but in no instance should a regiment be left on the field without two medical officers.

In time of action, the Army Corps Reserve Hospital and the ambulance company attached should be placed by direction of the Chief Surgeon of the Corps, after consultation with the Commanding General, at a point of easy communication with all the field hospitals, in order that it may move to their assistance when required.

It will be located later on the best and shortest route to railway or steamship connection, so that it can become a shipping depot or half-way refuge when the order is given to unload the field hospitals.

On long wagon routes the corps hospital, supplemented by divisional hospitals, if necessary, will be used as places of rest and refreshment for the sick and wounded. When this purpose

is fulfilled, its location will be changed, according to the movements of the Army Corps.

REGIMENTAL HOSPITALS.

General Orders No. 178, par. III., November 8, 1898, provides as follows: "The purpose of regimental hospitals in field service is to furnish protection and care to the sick of the command while on the march or in the field, or to those temporarily sick while in camps of instruction. It is an emergency hospital, in the one case and a detention hospital in the other, but it is not intended for the treatment of the very ill who, in the event of a move, would prove to be an incumbrance to the regiment.

"When cases are found to be serious in nature they should be promptly transferred to brigade or division hospitals, except where regiments are isolated, in which even the bed capacity may be increased as necessary, all of the sick being cared for and transfers made to general hospitals when ordered by proper authority.

"Of enlisted personnel there will be allowed, in addition to the three regimental hospital stewards now authorized by law, one acting hospital steward; six privates of the Hospital Corps as attendants and orderlies; one private of the Hospital Corps as cook, and one private for each ambulance and wagon. If members of the Hospital Corps cannot be obtained as drivers, the quartermaster department will hire civilians for that purpose.

"The tentage will consist of four hospital tents (two to be used as wards, one as dispensary and storage and one for the mess); one wall tent for the non-commissioned officers; three common tents for privates, and one common tent for cook tent.

"The allowance of ambulances and mounts, fixed in General Orders No. 76, June 22, 1898, from this office, and two four-horse wagons, will be furnished for each hospital. The allowance of medical supplies will be fixed by the Surgeon-General."

The G. O. referred to provides as follows:

1 ambulance to 400 men of the effective force.

1 four-horse wagon to 600 men of the effective force.

1 four-horse wagon to each brigade, horses for mounts.

For infantry regimental hospital stewards, 1; privates 1.

For cavalry regimental hospital steward, 1; privates 3.

For 3 batteries light artillery acting hospital stewards, 3; privates 1.

This allowance is defective, as in mounted commands all members of the Hospital Corps must be mounted; those who are not will be left behind.

"Requisitions for the necessary articles of camp and garrison equipage, tools, etc., will be based on official allowances. * * *

"Horses and wheel transportation will be furnished by the quartermaster department, and horse equipments by the ordnance department." * * *

Circular No. 12 A. G. O., November 15, 1898, authorizes the following outfit:

2 cases surgeon's field.
1 chests medical, Nos. 1 and 2 each.
1 chests surgical, Nos. 1 and 2 each.
1 chest sterilizer.
1 filter.
6 pouches Hospital Corps.
2 pouches orderly.

Disinfectants.—
12 bottles lime chloride.

Hospital Stores.—
12 cans condensed cream.
6 packages farina.
2 kilos soap castile.
2 bottles whiskey.

Furniture, bedding and clothing.—
10 bed sacks.
25 blankets.
4 blanket cases.
2 chests commodes.
1 chest food.
1 desk, field.
10 mosquito bars.
25 pillow cases.
12 pillows, hair.
2 chests, mess.
1 set folding furniture.
25 pajamas.
3 pillows, feather.
50 sheets.

Miscellaneous.—This list is omitted as it is so defective and insufficient that it will necessarily be changed.

"Timely requisition should be made for renewal of medicines, dressings and other articles expended. These requisitions must be sent to the Chief Surgeon of the Brigade or Division and when practicable should be promptly filled from the reserve supply of the brigade or division hospital." * * *

Personally I consider that the supplies of no hospital should be drawn upon by regimental surgeons, but that they should be got direct from the medical supply train, which is attached to each Army Corps.

"When a regiment is so located that its sick cannot be sent to a brigade, division or general hospital, the regimental hospital will be expanded to meet the requirements of the case.

"Regiments or smaller independent commands in permanent camps or barracks will be supplied in accordance with the supply table published in the Manual for the Medical Department.

"Chief surgeons should see that articles not really necessary are not included in requisitions approved by them simply because they appear on the supply table.

"Medicines and other articles necessary for the treatment of the sick, but not on the supply table, may be obtained upon special requisitions approved by the Surgeon-General or by the Chief Surgeon of a Military Department."

Wagon Transportation for the Divisional and Reserve Army Corps Hospitals.—There will be permanently assigned to every field hospital of any Army Corps six mule wagons, 12, mules, 72; two-horse wagons for medical supplies, 2, horses, 4; one-horse water carts, 3, horses, 3; baggage wagons, 48, mules, 288; medicine wagons, 8, horses for same, 16; water carts, 12, horses for same, 12; civilian drivers, 68. Total vehicles, 68; total animals, 316, to haul the tentage, subsistence and medical stores, the furniture, forage, etc.

While these trains will be under the control of the medical officers in command of the several hospitals, their immediate charge will be lodged with the quartermasters of the hospitals who will receipt and account for the public property. For the care of the transportation the quartermaster shall have his own drivers, blacksmiths, artificers, saddlers, traveling forges and all necessary tools to keep the outfits in good repair.

He shall make timely requisitions for vehicles or parts of the same, harness or animals to supply all losses and repair all breakages that may occur. He shall have his train always ready for service, and by daily inspection see that everything is in complete order. He will have at all times at least five days' forage for his animals and rations for his men, and a complete messing outfit that will be independent of the hospital to which he is attached.

Under ordinary conditions of civilized warfare it is believed that railways will permit a considerable reduction in the number of baggage wagons that may be needed over that required during our Civil War and the wars against Spain and in the Philippines.

It is thought that the distances between the field hospitals and railway stations, or terminals, will ordinarily be so short that wagons can make more frequent trips and in many instances the field hospitals will be able to depend largely on railway transport for its more bulky supplies.

THE GENERAL HOSPITALS.

The general hospitals for the new volunteer army will be established by direction of the Surgeon-General at such points as may be selected. They will be four or more in number and a description of one will apply to all of them except as to minor details.

"The hospital wards will be constructed as temporary frame buildings, 170 feet long, 24 feet wide, 11 feet to the plate, the walls to be plastered and ceiled and one window provided for every patient. The capacity of each ward will be 40 beds, allotting to every bed at least 72 superficial feet and air space of at

least 800 cubic feet. Provisions for adequate ventilation available for both winter and summer will be made, preferably by stacks and wind cowls. Attached to every ward will be a water closet containing at least four enameled flushing bowls, with a high water seat and automatic flushing tank. There will also be one slab urinal with a broad foot piece, and separate from the urinals and water closets will be the bath room and lavatory. In the former, there will be four enameled iron tubs and a stationary washstand containing six bowls, also of enameled iron, both hot and cold water being supplied through pressure bib cocks.

"There will be apartments for the ward nurse and ward master, also for the female nurses. There should also be a ward store room and pantry for preparation of special diets.

"In winter the pavilions will be heated with base burning coal stoves, where more elaborate methods cannot be had.

"Of these pavilion wards there should be constructed at least fifty to every hospital, providing for an occupancy of about two thousand patients.

"In addition there will be constructed the necessary administrative buildings for officers, operating rooms, laboratories, dispensaries, kitchens, mess rooms, store houses, stables, shops, steam laundries, quarters for the Hospital Corps and the guard, quarters for the officers, etc., in all some one hundred and fifty buildings."

The selection of a plat of ground, its accessibility by rail or water transportation, its preparation for suitable sewerage and water supply, and the general plan for the arrangement of the buildings in such groups as will conduce to effective and economical administration and supply, together with a most careful consideration of all its hygienic conditions, will be best determined by a board of officers, convened for that purpose which shall consist of two experienced medical officers and one officer of the quartermaster department, a building and sanitary engineer being employed as an expert if necessary; the revision of all proceedings being of course in the hands of the Surgeon-General of the Army or his representative. In laying out the plan of the general hospital I should personally favor an arrangement of pavilions in sections of ten wards each, the groups to have each its own administrative center which would consist of two buildings, one containing the surgeon's offices, the dispensary, the surgical operating rooms on the first floor, and the quarters for female nurses on the second floor, all complete with bath rooms, lavatories and closets; the other a long building containing the mess hall, kitchen, etc., on the first floor and quar-

ters for the non-commissioned staff and privates of the Hospital Corps on the second floor, all to be provided with the necessary baths, lavatories and closets. In adjacent buildings should be arranged quarters for the medical staff.

While the exact plan of the sections would necessarily be determined by the configuration of the ground and the nature of the country in which it was located, I think the following diagram will illustrate a convenient general arrangement of wards and attached buildings with a view to economy of ground space and exposure of wards to a maximum of light and air.

The Personnel.—The Executive Staff will consist of one Lieutenant-Colonel of the Army Medical Department in command of the hospital; one executive officer with the rank of Major; one Captain of the quartermaster department; one commissary officer; one Captain and Assistant Surgeon in charge of records and correspondence, and one Captain and Assistant Surgeon in charge of medical, surgical and hospital supplies and the preparation of all property requisitions, returns and accounts.

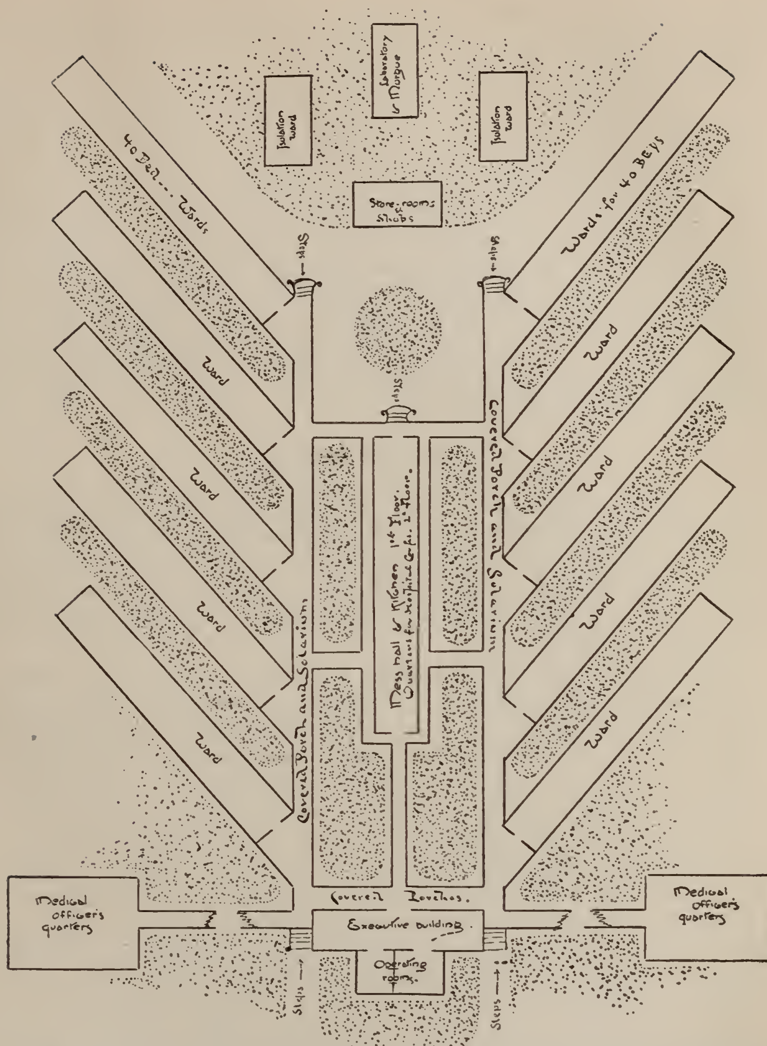
The Professional Staff will consist of commissioned officers, either regular or volunteer, and contract surgeons. They will be gentlemen of as high professional attainments as can be procured under the conditions which exist at the time. There should ordinarily be one Major and Surgeon for every 200 patients and one Assistant Surgeon, or Acting Assistant Surgeon, for every 40 patients. This number may be increased according to the gravity of the class of cases under treatment. Each surgeon in charge of a group will have the direct treatment of his own grave surgical cases and a supervising charge of a division consisting of five or more wards.

From the Surgeons and Assistant Surgeons, the commander of the hospital will select such a number of consultants and operating staffs as may be required; professional skill rather than conditions of rank will guide him in all such details. To every operator will be assigned three assistants, one of whom shall be a skilled anesthetist.

There should also be assigned to the hospital a skilled pathologist, microscopist and bacteriologist, and a number of trained nurses, either male or female, to complete this staff.

Connected with every general hospital should be an ambulance train, under the command of a First Lieutenant and Assistant Surgeon, for the transportation of the sick and convalescents to and from the hospital.

The enlisted personnel of the hospital will be as follows: 10 hospital stewards, 40 acting hospital stewards, and 240 privates of the Hospital Corps who shall be organized into companies



The Ground plan of a single section of a United States general hospital of 2,000 beds. The section has a capacity of 400 beds.

of sixty men each and assigned by the commanding officer as cooks, nurses, attendants, etc., according to the best interests of the service. They shall be regularly instructed in classes by commissioned officers and hospital stewards in first-aid to the

injured, the principles of nursing, the preparation of diets, the care of public property, and later, if there be time, in the school of the soldier and litter-bearer drill.

It is proposed that each general hospital shall be planned to accommodate about 2,000 patients, but it can be arranged to shelter a greater number, by increasing the number of groups, each one of which will practically be complete in itself.

Guard.—In every large hospital there should be a guard of at least two companies of infantry under the command of a field officer or an experienced officer of the line, this officer to receive his orders from the commander of the hospital in all matters pertaining to the protection of public property and the preservation of good order in the hospital. There should be an adequate guard room and barracks with a kitchen and mess hall for the use of this command.

V. MEDICAL RECORDS.

Next in importance to the preservation of the health of our forces and keeping them up to the highest point of physical military efficiency, comes the preparation and preservation of the prescribed medical records of all cases of sickness and injury, by which a soldier is either temporarily or permanently non-effective for military duty.

The greatest financial burden on the treasury of our country and on its tax payers has been the pension list, which has steadily grown until the breaking point of the tax payers' patience seems almost in sight. From the paltry 5,000 pensioners of 1865 to 1867, the list has swollen year by year until the million mark is nearly reached, while the money expenditure on this account is over $160,000,000 per annum and may soon reach $200,000,000.

All pension allowances under our present laws are based on the disability of the claimant which must have been contracted while in the service of the United States and in the line of duty. To substantiate these claims for the benefit of the applicant and to protect the United States against false claims to its bounty, it becomes absolutely necessary that a record of all cases of sickness and injury should be made, whatever their nature, whether grave or trivial, whether existing or merely feigned, at the very time of their occurrence. The memory must not be trusted, and only absolute loss of every species of writing material, which happened to nearly every medical officer during the early weeks of the Santiago campaign, can excuse a neglect of this important duty.

The basis of all medical records is the daily sick call, held

at such hour as the commanding officer may direct, when all who wish are marched under charge of a non-commissioned officer of the company to a designated point to see the Surgeon. The non-commissioned officer carries with him the company sick book in which are entered the names of the men who report for examination, and the Surgeon enters thereon a statement whether the soldier is excused from duty or not, and the names of those who, having been sick, are returned to duty. He then prepares has morning sick report of all the companies for the commanding officer. This, a numerical report, made in a book kept for that purpose, shows the number of sick remaining at the last daily report, the number admitted, the number admitted to quarters and hospital, the number returned to duty, sent to another hospital, died, discharged for disability and remaining sick at the date of the report. All changes are noted by name, giving the company and regiment of every soldier. Entries are now made in the register and prescription book, which shows the name of every soldier prescribed for, the nature of his complaint, the disposition of his case and his treatment. From these daily preliminary records is made the formal register of sick and wounded, and the monthly report of the same, which gives in detail all information required, not only by the Medical Statistical Bureau, but also by the Pension Office.

In time of war only two copies of this report are required at the end of the month, one for the Surgeon-General's office, which is to be forwarded through the Chief Surgeon, the other for retention in the hospital, or with the command. Blanks for this report are obtained through the Chief Surgeon and from the Adjutant-General's office.

The second daily record is called the *Morning Report of the Hospital Corps,* which is made in a special book ruled for that purpose, and furnished by the Adjutant-General's office. It shows the number of stewards, acting stewards and privates of the corps on duty with the command; all changes in the detachment by sickness, absence, or detached service; the joining of new men, etc. This report is made up and forwarded to the commanding officer through his adjutant with the morning sick report, at or before 8 A. M. every day.

The Monthly Reports are given in the Manual for the Medical Department as follows:

1. The Sanitary Report, which is a report of the monthly sanitary inspection of the post or command, and recommendations made by the medical officer. (Form 4.)

2. The Report of the Sick and Wounded, as stated above. (Form 25.)

3. The Monthly Return of the Hospital Corps to the Surgeon-General and Chief Surgeon of the Corps. (Form 32.)

4. Monthly Statement of the Hospital Fund (Form 35), to be forwarded through the Chief Surgeon, who verifies the same and transmits it to the Surgeon-General.

5. Report of Meteorological Observations (now discontinued).

6. Report of the Physical Examination of Recruits. (Form 30.)

7. A Personal Report of Stations and Duties, to the Surgeon-General, through the Chief Surgeon, also to the Adjutant-General of the Army.

8. Report of Repairs to Hospitals and Hospital Stewards' Quarters (not required during field service).

9. Report of Issues and Sales of Medicines to Civilians, where any are made.

Yearly and Occasional Reports.—

1. Returns of Medical Property.—This is also made when the officer is relieved from the care of the same.

2. Report of Record Books on Hand, also made when the officer is relieved.

3. Estimates or Repair to Hospitals and Hospital Stewards' Quarters.

Occasional.—

1. Report of Epidemic Diseases, when they appear in the command or at a hospital.

2. Report of Deaths, to the Adjutant-General and Surgeon-General, in case of officers, and also by burial certificate to the adjutant of the command.

RECORD BOOKS.

The Surgeon of every regiment and hospital is required to keep the following records:

1. A Book of Letters Received.

2. A Book of Letters Sent, both indexed, which are supplied by the Quartermaster Department.

3. A Sick Report Book for the Hospital Corps.

4. A Company Clothing Book.

5. A Descriptive and Deposit Book, all supplied by the Adjutant-General.

6. A Record of Vaccinations for the Hospital Corps will be entered in the Descriptive and Deposit Book. (See par. 264, A. R., *Quartermaster Property.*)

The records of each detachment will contain full information respecting all quartermaster supplies, showing list of articles, date of receipt, from whom received, name of officer who signed

the memorandum receipt therefor; also an account of all articles turned in to the Quartermaster, expended, lost, stolen, or destroyed, and the company or detachment commander will have a quarterly settlement with the Quartermaster, and one when relinquishing his command. (See par. 265, A. R.)

ORDNANCE PROPERTY.

Officers are accountable for all haversacks and their contents, canteens and straps, waist-belts and plates issued to them and which are intended for the use of the members of the Hospital Corps, and they are required to make quarterly returns of the same to the Chief Ordnance Officer of the Army. Also when they are relieved from their commands. Blanks for this purpose and also for the transfer of ordnance property are to be had from that department or from the ordnance officer attached to the command.

Miscellaneous Blanks.—Descriptive Lists of the Soldier are required whenever he is detached from his command, and sent to a field or general hospital, or from one command or hospital to another. These lists give an accurate description of the man, and a statement of his account with the United States in the matter of pay and clothing and are indispensable in preparing muster and pay rolls or in settling his account when he comes to be discharged from service, either from disability or by expiration of his term of enlistment.

Final Statement.—This is a paper given to the soldier on his discharge, showing his account with the United States and all facts necessary to its settlement and his final payment by the paymaster.

Certificate of Discharge from Service.—Is made out giving an accurate description of the soldier, his company and regiment; where and by whom he was enlisted; date, cause and place of discharge, and finally his character as a soldier, and whether there are any objections to his re-enlistment.

Certificates of Disability.—This paper is prepared by the company commander whenever it is desired to discharge a soldier from service on account of physical disability. It is submitted through the adjutant to the Surgeon who fills out the required medical certificate. It is then returned to the Commanding Officer, who forwards it to the Department or Corps Commander for final action. The papers are reviewed by the Chief Surgeon and require his approval.

All blanks necessary for the foregoing are furnished by the Adjutant-General.

The Book of Transfer Slips is required to be used when a

patient is transferred from one hospital to another or from one command to another. It gives a description of the soldier, a brief history of his case and a statement whether his disability was contracted in the line of duty, and any other information necessary to the continuation of his record. It is issued by the Surgeon-General's office.

The following list of the contents of the field desk pertaining to the medical department, will give a good idea of the records that are to be furnished or kept by the medical officer.

Books.

Army regulations, 1 copy.
Drill regulations for the hospital corps, 1 copy.
Hand-book for the hospital corps, 1 copy.
Information slip, book, 1 copy.
Information slip, book desertions, 1 copy.
Morning report, book, hospital corps, 1 copy.
Morning report, sick and wounded, 1 copy.
Order and letter book, 1 copy.
Register and prescription book, 1 copy.
Manual for the medical department, 1 copy.
Transfer book, 1 copy.

Stationery.

Full supply blanks.

Medical Department.

Examination of recruits monthly, No. 4.
Hospital fund statement, No. 4.
Medical property, return of, No. 2.
Medical supplies, invoice of, No. 6.
Medical supplies, receipt for, No. 6.
Medical supplies, special requisition for, No. 8.
Report of sick and wounded sheets, No. 12.
Report of completed cases, sheets, No. 12.
Return of personnel for the hospital corps, No. 6.

Subsistence Department.

Ration returns, No. 12.

Ordnance Department.

Invoices, No. 2.
Receipts, No. 2.
Quarterly statements, No. 2.

Adjutant General's Department.

Certificates of disability, No. 2.
Descriptive lists, No. 2.
Discharges, No. 2.
Final statements, No. 4.
Furloughs, No. 2.
Inventory of effects, deceased soldiers, No. 2.
Muster rolls, No. 8.
Pay rolls, No. 12.
Outline figure cards, No. 6.
Physical examination of recruits, form, No. 6.
Surgeon's certificate for officers, No. 6.

VI. TRANSPORTATION OF THE SICK AND WOUNDED.

HAND CARRIAGE.

Hand carriage will be by litters or in other ways as prescribed in the Drill Regulations for the Hospital Corps, which should be carefully studied in this connection.

CARRIAGE BY VEHICLES.

Ambulance Trains.—To every Army Corps of about 40,000 men there should be a special train of at least 150 ambulances

drawn by either two horses or four mules, according to the nature of the country and its roads; 24 six-mule wagons; 8 four-mule wagons; 8 two-horse medicine wagons and 8 one or two-horse water carts.

This train will be under the immediate charge of an officer of the quartermaster department or an officer of the line, who may be appointed by the Corps Commander, an Acting Assistant Quartermaster for that purpose, who shall make requisition for the property required under direction of the Chief Medical Officer of the Army Corps and will receipt and become accountable for the same. This will include the entire equipment of the train except the medical supplies and surgical supplies for which the senior medical officer assigned to duty with the train will be accountable.

The Acting Assistant Quartermaster will attend to all replacement and repairs of ambulances, wagons and harness and make timely requisition to supply new vehicles or animals to replace those destroyed or broken down in service. He will, also, under the supervision of the Surgeon in charge of the train, have direct control of all drivers and stable men detailed from the Hospital Corps or otherwise attached.

The train will be supplied with a traveling forge, an ample supply of spare parts, horse and mule shoes, one or more blacksmiths, one or more saddlers, an artificer and a complete outfit of tools for each of these workmen to keep everything in good order and repair while in the field.

The medical officer detailed with the ambulance trains will be one whose rank is superior to that of the Assistant Quartermaster, and in all matters pertaining to the transportation of the sick and wounded, he will have control and be responsible, receiving and carrying into effect the orders of the Chief Surgeon of the Army Corps, who shall have exclusive command of the train as a whole. He will also command all medical officers, stewards and Hospital Corps men attached to the train in any capacity.

Sections.—The train will be divided into four sections of about thirty-four ambulances each, made as equal as possible in the number of vehicles and equipment, the remaining fourteen (14) being held as a reserve with the train. There will be one section for each division of the corps and the fourth will be held at the Army Corps Headquarters and Reserve Corps Hospital.

Medical Personnel.—The personnel of each ambulance train will be as follows: One Major and Surgeon in command; 8 Assistant Surgeons attached; 1 Acting Quartermaster; 4 Hospital Corps sergeants (stewards); 16 Hospital Corps corporals (acting stewards), and to every ambulance one driver and one attend-

ant, both privates of the Hospital Corps. One driver of the quartermaster department will be attached to every wagon and cart. Total, 10 officers, 320 enlisted men and 59 civilian employés.

Control.—The Chief Medical Officer of each Army Corps shall have the direction and supervision of the several ambulance trains and of all the officers and men attached thereto. Chief Surgeons of Division will control such sections of each train as may be assigned to their divisions.

It shall be the duty of the Medical Director of the Army Corps, previous to a march or before or during an action, to issue proper orders to the medical officer in charge of the train for collecting the sick and wounded and conveying them to their destination. All available ambulances belonging to the Army Corps may, by the direction of the Chief Medical Officer thereof, be used without reference to the divisions to which they may have been assigned, and may be used in transporting wounded to the hospitals, so that no part of the train shall be overburdened with work while another part is idle.

When it becomes necessary to utilize the wagons in the transport of the wounded, the Corps Director should give the necessary orders to have all wagons loaded with hay or brush; he will also specify the number of days' rations to be taken with the train on its movement, the number of medical officers and Hospital Corps men of the ambulance companies that should accompany detachments of the train, and will give instruction as to roads, places for camping, location of railway stations and hospitals into which the wounded are to be moved.

When the troops remain in camp for some time, it will be convenient to have near each division, a few ambulances with horses hitched, ready to convey patients to the several hospitals. These are to be known as the *corps picket ambulances*. Their posts should be marked by a red-cross guidon. With this picket will be a small detachment of Hospital Corps men and a medical officer, also an acting steward and a chest of medical and surgical supplies. The picket ambulances are to be relieved every twelve hours.

During the Civil War the number of ambulances was fixed on the following basis: To every regiment of infantry composing the division, there was allowed 3; to each regiment of cavalry, 3; to each battery of artillery, 1, permanently attached.

Under the provisions of General Orders No. 76, June 22, 1898, the following was the allowance of wheel transportation assigned to the medical department of the Army Corps of 25,000 men: One ambulance to 400 men of the effective force; one

4-horse wagon to 600 men of the effective force, and one 4-horse wagon to each brigade. This would give a total of 112 vehicles and 448 animals for the corps, exclusive of mounts for certain members of the Hospital Corps.

I do not consider this number sufficient for the needs of the service, except where the lines of haulage are very short, and the hospitals are not expected to accompany the command by wagon transportation.

Under the provisions of the same order, the tentage is placed as follows: For each ambulance company of 104 men each, 17 common tents for privates, and two common tents for non-commissioned officers. This will crowd six privates into a tent that is intended to accommodate only three, and five non-commissioned officers where there should be but two. Either one-half of the men of the command will have to use their shelter tents or stand in the rain while the other half are sleeping.

For the division hospital there is equal over-crowding of the Hospital Corps men. Six to the tent of the privates, when only three men can lie down at one time and five non-commissioned officers. There is also provided one common tent for supplies and hospital tents on a basis of six beds for patients for each tent. For the patients at least, it may be said that the allowance of tentage is fairly adequate under very favorable conditions, but in other respects the allowance is totally insufficient.

Under existing conditions of warfare and the very large number of wounded that may be thrown on the hands of the medical department in a single engagement, I consider that a corps ambulance train should be upon the following basis: To 27 regiments of infantry, 81 ambulances, or one for each battalion of 400 men; to 1 regiment of cavalry, 3; to 8 batteries of artillery, 8; to 1 battalion of engineers, 2; to the supply train, 1; for the divisional hospitals, 48; to the reserve wagon train, 7; total, 150. The wagons are necessary to haul the forage for the train, rations for the men and reserve medical and subsistence stores for the field hospitals of the corps, and the sick and wounded under their charge.

Equipment of the Ambulances.—Every ambulance should be supplied with the following necessary articles: 2 litters, 2 water boxes, 2 lanterns, 1 wrench, 1 bucket, 1 hatchet, 1 bundle of leather thongs for repairs, and one paulin which can be used as temporary shelter for the wounded.

The sections of the train will be provided with the following articles:

1. A complete mess outfit for the personnel of the train, who should be divided into separate companies for that purpose.

2. Special apparatus for the preparation of nourishing food and hot soups or drinks for the wounded, while en route.

3. The medical supplies, chests, surgical, Nos. 1 and 2 for each section, 1 set; chests, sterilizing, 1; buckets, agate, 3 in nest, sets, 1; litters, extra, 20; litter slings, as required; first-aid packages, 1,000; one Hospital Corps pouch for every ambulance attendant; 1 orderly pouch for every medical officer; 1 surgical field case for every section; 1 field desk for the train; 3 mess chests; 3 food chests; 3 commode chests; 600 blankets; 300 hair pillows, and 300 rubber covers for pillows. The blankets are absolutely required to prevent men from dying of cold and collapse, even in tropical countries, during transportation from the field of battle. All this property should be marked "U. S. A. Med. Dept." and should remain with the train. For the purpose of repairing roadways and the crossings of streams, there should be one spade, one pickaxe and one axe with every wagon. Also the same outfit to every third ambulance. Spare tongues and whiffletrees are also to be provided, to repair breakdowns that are constantly occurring.

A complete outfit of tents for officers and men is also required for camping purposes. When actively moving, the tentage will have to be reduced to a minimum.

There are two styles of ambulances used at present in the United States Army. Ambulance No. 1 may be designated as a post ambulance, for prior to the late war with Spain, so far as I know, at least, it had little use outside of the military stations to which it was attached. For field service I have found that this ambulance has several defects which might be mentioned here. The running gear is adapted only to city pavements and smooth country roads that are all well rolled and beaten down, for the reason that the narrow tires of the wheels cut deeply into sand and mud and make it very hard to pull over bad roads. Again, the forward wheels are too small for either easy draft or easy riding, as they jolt into holes and ruts that larger wheels would span. Again, it is arranged for two patients only, in a recumbent position. This fact lowers the carrying capacity of an ambulance train one-half, which under some circumstances is a serious matter. The vehicle itself, however, is more comfortable than the "double-decker," which was provided to the Army in large numbers on the outbreak of the Spanish War. Lastly, the tongue which was so slight that it broke in hard service, was unprovided with any arrangement for attaching an additional

team in case of necessity, single teams being insufficient except over good roads.

Ambulance No. 2 is a "double-decker." This vehicle has several of the faults of No. 1, but has the advantage of easier running, because of its wide tires, and of a greater carrying capacity. The tongue is also provided with a goose-neck for another team. Its brake, however, is too light to hold a heavy load, and also its tongue is too light. This ambulance is provided with a movable upper shelf for recumbent patients, thereby doubling its capacity, but crowding its over-head space to a point of almost suffocation, and on hot, dusty roads the men must suffer greatly, for which reason this style of ambulance should rarely be loaded to its full capacity and only under great stress of time and numbers of wounded.

For practical field work I have often found it quite convenient to attach a canvas apron about four feet square beneath the bottom of these ambulances, where the men's kits and arms can be stored during transit. The apron is also useful for the carriage of a sack of grain to feed the animals, likewise spare utensils, etc. It is lashed to the underworks with stout leather thongs and should be a part of the equipment of every ambulance for field service. It will be well to give a hint that eyelet holes would better be placed in the center of this apron, to permit the drainage out of water in case the train crosses a stream.

RAILWAY TRANSPORTATION OF THE SICK AND WOUNDED AND THEIR SUPPLIES.

Experience has demonstrated that the success of military medical administration is almost wholly dependent upon the lodgment of the power to do in the same hands with the responsibility for doing. Division of authority entails weakness of administration, for it is human nature to place responsibility for unhappy results on other shoulders if possible. For that reason, in this discussion, it will be held that the Surgeon-General of the Army should have entire control of such railway transportation as may be required to move the sick and wounded from the field to the base or general hospitals. He will have the control, also, of all hospital transports, boats, barges and steam launches for the conveyance of medical supplies and stores for the sick, and all rail shipment of the same.

The lesson of the Spanish War should not be forgotten, where one overworked transportation department was overwhelmed with a confused jumble of ordnance stores, subsistence supplies, tents, harnesses, first-aid packets, baggage wagons, medicine, and the thousand other things needed by an army,

all loaded on the same trains and cars or tumbled into the holds of the same vessels, without bills of lading or package marks to show contents and the Medical Department supplies always the last to receive attention. What was to be expected but a breakdown? No one officer, nor a hundred officers, were they giants of skill and energy, could have prevented a collapse under such a system.

Hospital Railway Trains.—Every hospital railway train should consist of fourteen cars. Those now known under the name of "*tourist sleepers*" being widely available in this country, should be obtained either by charter or purchase at the very commencement of organization. These are preferable to the more elaborately upholstered standard Pullman sleepers, because they are more easily cleaned and kept in proper sanitary condition. Each of these sleeping cars will accommodate twenty-four patients, twelve grave cases occupying the lower berths and twelve lighter cases the upper. A dining car should be placed at the rear of the train and a dispensary car, one-half of which will be fitted up for a surgical operating room, will be placed in the center of the train. Each train will have one or more baggage cars to serve as store-rooms for supplies, and one car will be allotted to the stewards and Hospital Corps privates and the medical staff. All cars will be of the latest vestibule pattern, and arranged so that a litter loaded with a patient can be carried from one end of the hospital section to the other. Every car should either be quite new or thoroughly disinfected before use and at regular intervals thereafter. The water tanks should be ample and separate from the water-closets. A small portable crematory should be put on every train for the destruction of infected discharges and dressings. Linen closets should be stocked with bedding and comforts for the sick, and the kitchens with a good supply of extra diets.

Every car should have a field commode chest and every requisite article for nursing. The operating room should be equipped with an operating table, two steam sterilizers, a gas or oil stove for heating the same, a surgical chest and a reserved supply of surgical dressings and appliances. The dispensary should be equipped as for a field hospital of 240 beds. There should be writing desks for the stewards and the medical officer. The dining car should be equipped with a cooking range and the requisite table outfit for feeding at least 300 persons. There should be large refrigerators on board and a plentiful amount of ice. There should be fresh meat and other subsistence stores to meet all demands of the sick and attendants for at least five days, for it can not be foretold, even on an apparently short run,

what delays may occur from broken bridges, washouts, side-tracking for movement of troops, or the operations of the enemy. Lastly, in the way of equipment, hospital trains should carry appliances for breaking open cars and the rescue of the sick in case of wrecks, also for the extinguishment of fires, and tent flies and poles for the shelter of patients in case the cars are destroyed by accident.

It is also important that every hospital train display the red-cross flag conspicuously in front and rear and on the sides of the cars to protect it from the fire of the enemy, and in times of emergency it should have the right of way over other trains.

Personnel.—Every hospital train will be under the command of a medical officer with the rank of Major in the U. S. Volunteer Medical Department. With him will be two or more Assistant Surgeons. The officer in command will receive orders from the Chief Medical Officer of the Army or Corps with which the train is connected and from him alone. He will receipt for all property issued to him and be accountable for the same. The train crew, with its engineer, fireman, brakemen, conductor, etc., will, while on duty, be under the control of the Medical Department so far as the general operations of military trains will permit. The exact limits of this control, however, can hardly be defined in advance of actual conditions. As cooks, nurses, attendants and litter-bearers there will be assigned a detachment of the Hospital Corps and a number of trained nurses, as follows: One hospital steward, three acting hospital stewards, sixteen privates, one for cook, one for assistant cook; one attendant for the dispensary, one for the operating room; a trained nurse and two Hospital Corps privates for every car containing grave cases; one private for each of the other cars; one for the storeroom. Every train will be furnished with ten litters and two rolling chairs.

The total capacity of each train will ordinarily be 240 patients. While this number may be increased by adding to the number of cars or by placing two patients in some of the berths, it is believed that twelve cars carrying the above number of sick is about the maximum that can be properly cared for.

Loading the Train.—At the point of reception, the train should be divided into two sections, each of which should be opened from end to end, the bearers of the ambulance company assisting to load the cars. The patients will be carried in by the rear platforms, to which stagings should be laid. They will be passed through to the front car, and when the line of loaded litters fills the section they should be unloaded and the patients put into the berths by the bearers. The upper berths for

the less serious cases should be filled first, the lower ones being reserved for the graver cases. The litters being unloaded, the bearers will fold them and pass out by the front platform. The personal effects of the patients should be rolled into bundles, checked and placed in the baggage car for safe keeping.

Number of Trains.—While the absolute number of vestibuled hospital trains must be determined by the number of sick and wounded accumulated in the field hospitals, I think it would be proper to equip one train for each Army Corps and, as far as practicable, its operations should be confined to the region where that body is located.

A reserve train should be provided to assist the Army Corps most heavily burdened with wounded. These trains should not be merely extemporized as occasions arise, but should be established and equipped at the earliest possible moment and form a permanent part of the Medical Department during the war.

VII. Hospital Ships and Steamers.

The honor of having originated and developed hospital steamships on a large scale belongs solely to the Medical Department of the United States Army. During the Civil War, 1861 to 1865, this department fitted out several steamers for that purpose, the finest of them being the *D. A. January,* a large Mississippi River boat, for service on the inland waters of this country, and the *J. K. Barnes,* a side-wheel steamship for ocean service. For an extended description of these useful vessels reference is invited to the last volume of the Medical and Surgical History of the War of the Rebellion and to models of the ships, which were most exquisitely worked out and which have been on view at every great exposition in which the United States Government has taken part. They are now deposited in the Army Medical Museum at Washington.

In our recent Spanish-American War, as Chief Surgeon of the Fifth Army Corps, and just prior to the departure of that expedition to Santiago de Cuba, the writer was so fortunate as to secure the passenger steamship *Olivet,* which had been chartered by the Quartermaster Department as a transport for troops, and was being used at the time as a water-carrier for the other ships of the expedition, for service as a hospital ship. On this steamer I placed the Second Divisional Hospital, which had been organized for field service while the troops were encamped at Tampa, and was under the command of Major A. H. Appel, Surgeon U. S. Army.

In less than twenty-four hours he was on board with all

his equipments, had the boat ready for service and began at once to remove the sick from the various troopships which were lying in the barbor of Tampa Bay, and to care for them until they could be transferred to field hospitals on shore.

On departure of the expedition, the *Olivet* was cleared for action and followed the fleet to Cuba, anticipating the hospital ship *Relief* by nearly one month, and arrived in ample time to take on board all the wounded from the affair at Las Guasimas, and later as many as possible of those received after the terrible assault on San Juan Hill. In obedience to my instructions, Major Appel landed all his tentage and camp equipage, including his cots and bedding, transferring the same to the reserve corps hospital, under Major L. A. LaGarde, Surgeon U. S. Army, at Siboney, and the *Olivet* continued her service until she was sunk at her dock in the harbor of Savannah.

This steamer had stateroom accommodations for about 280 persons, a part of the same being on the upper deck. Although a cranky boat in rough water, her interior arrangements were very comfortable for the sick and wounded except such as had gunshot fractures of the lower extremities, who were unavoidably cramped by the short and narrow bunks in the small staterooms. Then, too, a greater number of nurses was required to attend the sick than in an open ward, and less constant supervision could be enforced than would have occurred had the deck spaces been clear of staterooms and had standard iron bunks with woven wire mattresses been in their place. But all that was to come later.

On the 2d of July, 1898, the first Army hospital ship was ready for service in the war with Spain.

The *Relief* is a screw iron steamer, 306 feet long, 46 feet broad and 29 feet deep, originally built for passenger traffic between New York City and Portland, Me. She has five wards, each with water-closets, bath, and mess-rooms adjoining. All are painted white throughout, except the floors, which are chocolate brown. They are well ventilated and lighted at night by electricity. Iron bunks are in double tiers and placed fore and aft in two lines on each side of the wards, leaving commodious lengthwise and transverse passages between them.

Ward No. 1, on the after part of the upper deck, is 68 feet long, 32 feet wide in its broadest and 24 feet in its narrowest width, has 76 beds.

Ward No. 2, forward on the same deck, is 66 feet long, 32 feet wide in its broadest space, 24 feet in its narrowest width, has 62 beds. In the center of the midship space between the wards are the engine and the boiler enclosures, with, on the port side,

the ward masters' and nurses' rooms, lockers, mess-rooms and water-closets, and on the starboard side the dispensary and the rooms of the engineers and oilers.

Ward No. 3 is aft on the main deck, 79 feet long, 38 feet wide in the broadest and 28 feet in the narrowest part, and has 76 beds. The operating room is partitioned off from the fore part of this ward on the starboard side.

Amidships on this deck is the galley and bakery, with the mess-room for hospital attendants aft and the mess-room for sick officers forward on the starboard side, and the quartermaster's office, clerks' rooms, laboratory and dark-room, attendants' water-closets and officers' ward mess-room on the port side.

Ward No. 4, of 30 beds, for officers, 38 by 24 feet, is forward of the midship space. Occupying that part of this deck between the ward and the forecastle space for the crew are the quarters, mess-room, pantry, baths, etc., for the medical officers and the office of the executive officer.

Ward No. 5, 37 feet long, 41 feet wide in its broadest and 36 in its narrowest part, containing 46 beds, is on the lower deck, with a crew space separating it from the steering engine.

On either side of the boiler and engine enclosures are coal-bunkers, with the laundry and drying room to port and store-rooms to starboard. The forward part of this deck provides space for disinfecting and ice-making apparatus; storerooms, ice-box and chill rooms, elevator, steering and windlass engines, staterooms, water-closets and quarters for the crew. On the orlop deck aft of the engine and boiler-rooms are water-tanks and rooms for medicines, medical stores and quartermaster stores, while forward are coal-bunkers, a dead-house and rooms for commissary stores, etc.

On each side of the hurricane deck are four lifeboats and a 28-foot steam launch, while forward of the funnel are the pilot-house and staterooms of the ship's officers. Abaft the funnel are the hatches, sky-lights and life rafts.

The hospital staff consists of the commanding officer, a Major and Surgeon U. S. Army, with six medical officers, three hospital stewards, four acting hospital stewards, twenty-nine privates of the Hospital Corps and twenty trained nurses.

The *Missouri* is 320 feet long, 40 feet beam and 29 feet 6 inches molded depth. Her between-deck space is 7 feet 6 inches, which gives good room for hospital accommodations. She carries about 380 tons of fresh water in her ballast-tanks besides having large condensers. In outfitting her for hospital purposes a steam laundry, steam sterilizing apparatus and ice and carbonating plants were provided. Her medical staff consists of one

Major and Surgeon of the U. S. Army in command, three medical officers, two acting assistant surgeons, two hospital stewards, seven acting hospital stewards, forty-seven privates of the Hospital Corps, eleven male contract nurses, one chief cook and four assistants, one laundryman and three cabin boys. She carries a large amount of medicines and medical and hospital property and supplies and will accommodate about 250 patients.

This ship differs from the *Relief,* having no cabin accommodation on the upper deck. While this fits her better for rough weather, she is less comfortable in tropical waters and her wards become greatly overheated when lying at anchor in calm weather. Both the *Relief* and the *Missouri* were primarily for service near home and are hardly fitted for voyages extending over three weeks on account of their limited coal capacity. As Major A. E. Bradley, Surgeon U. S. Army, reports in regard to the *Relief:* "All available space was given up to coal, which was put in sacks and distributed between decks after filling all bunkers. * * * The margin of coal excess is so small that in making frequent trips (to the Philippines) sooner or later storms would be encountered which would so delay us that the fuel supply might be exhausted before port could be reached. The vessel, too, is not properly constructed to endure the severe storms which prevail in the east. Should a typhoon be encountered at sea it is quite likely that all the upper portion of the vessel would be blown away and it is in this portion that all the sick are carried.

"This very construction, however, makes her admirably adapted for hospital purposes, as plenty of light and air gain free admission to the wards."

I consider that the principal fault in all these steamers is their limited carrying capacity and steaming radius. It would be more economical to have one vessel of 5,000 tons, that was fitted to carry 900 patients, than three vessels of 300 capacity each. Then she would be safer, less unsteady and could go around the world if necessary on her own coal.

From what I have seen of these hospital ships, I would say that they are too low between decks, have too many bunks and not enough sitting room for convalescents. The number of water-closets should be largely increased for use of the patients, because of the human habit of early morning defecation, particularly in chronic diarrheal troubles, with which the mass of sick soldiers are afflicted. The electric fans with which they are abundantly supplied should be connected with fresh ducts from the outside; simply to stir up the foul air within a ward is not to effect ventilation.

The interior arrangement of our present hospital ships, however, is a vast improvement on anything that has been yet attempted, and time alone is necessary to make them the models of the world.

In addition to the large vessels just described, small flat-bottomed steamers should be provided of sufficiently light draft to enter shallow bays and rivers, with arrangements for landing without the aid of docks, as has been for many years the custom of all river boats on the inland waters of the United States. Each of these boats should be equipped as a hospital of 250 beds, with a proportionate complement of medical officers, Hospital Corps men, nurses and supplies.

MEDICAL SERVICE ON ARMY TRANSPORTS.

The problem of an efficient medical service on Army transports has only recently been presented for solution in this country. In the fleet of transports carrying the Fifth Army Corps to Santiago, the voyage itself was of short duration and special accommodation for the sick, except that furnished by the *Olivet*, was not required. But when the troops returned to the United States and the Eighth Army Corps was sent to the Philippine Islands, the voyage to which covers nearly thirty days at sea, under most trying conditions as to defective ventilation and over-crowdings, to which the troops were subjected, special arrangements for the care and treatment of the sick became imperative.

To this end a board of officers was convened in November, 1898, of which Major-General William Ludlow, U. S. Volunteers, was president, which drew up the regulations of the Army Transport Service, which were approved and published for the guidance of all concerned.

Two headquarters for the service were immediately organized, one at New York City for the Atlantic traffic, and the other at San Francisco for the trans-Pacific traffic. Various departments in the service were defined, including a medical superintendent, transport surgeons, etc.

From the report of the Surgeon-General of the Army, 1899, I quote as follows:

"The prescribed status of the medical superintendent required that he should be an officer of the Medical Department of the Army stationed with the general superintendent, and acting as his assistant and professional adviser in all matters pertaining to the sanitation and hygiene of the transports, and to the hospital and medical accommodation and service on board.

"He was required to make personal and minute inspection of each transport on arrival and prior to departure, and to sub-

mit to the general superintendent such recommendations relative to sanitation and hospital equipment as he might deem needful. He was required to make himself familiar with the quarantine laws and facilities at home and over-sea ports and be responsible for the competency and satisfactory service of the transport surgeons and all other employes of the Medical Department of the Transport Service."

The duties of transport surgeons were prescribed as follows:

"To each transport will be assigned a transport surgeon, who will be selected or appointed with special reference to the needs of the transport service and under direction of the Medical Superintendent and of the transport quartermasters, and will act as the medical officer of the ship. He will be responsible for the proper hospital equipment and supplies of the vessel, for its proper and thorough sanitation, for the care and treatment of the sick and injured and for the satisfactory service of the hospital employes.

"To meet the requirements of the service for transport surgeons, as well as for the general service, a board of medical officers was assembled in New York City and candidates for the position of contract surgeon were invited, by the Surgeon-General of the Army, to appear for examination.

"The following requirements were exacted by the board of examiners: Evidence of graduation at a regular reputable medical college, diploma to be submitted to the board; proof of hospital or other professional experience will be of benefit to the candidate. Candidates must be in good health, of reasonably sound physique, and citizens of the United States.

"The examination is of a practical nature, embracing hygiene, practice of medicine, pathology and surgery. In addition a thesis on some professional subject will be prepared by the candidate."

Major Henry S. Kilbourne, Surgeon United States Army, was assigned to duty as Medical Superintendent.

Circulars of instruction were prepared for transport surgeons.

All medical supplies for fitting out transports were promptly furnished by the medical supply depots on requisition approved by the Medical Superintendent. Medical supplies for three and six months for the maximum number of troops and crew carried by the transport were placed on board and replenished when necessary on the return voyage.

The medical personnel of each transport consisted of one acting assistant surgeon, one steward or acting steward and from

one to three privates of the Hospital Corps, according to the needs and accommodations of the ships.

Since January, 1899, the transports *Grant, Sherman* and *Sheridan* were dispatched with a full complement of troops by way of the Suez Canal to the Philippine Islands. These vessels are now plying on the Pacific route, together with the *Logan*, the *Thomas* and the *Meade*.

The plans of these ships include facilities for heating, ventilation and refrigeration, for lavatories, closets and baths, all of the most modern type, together with berthing and messing accommodations for four battalions of infantry, with hospital accommodations for sixty patients on the main deck aft, including operating room, dispensary, attendants' room, etc.

They have double white enameled bunks with woven-wire mattresses and complete outfit of hospital bedding and clothing. The wards are lighted by electricity; heated, when necessary, by steam coils and cooled by electric fans.

VIII. MEDICAL PURVEYING.

THE PURCHASE OF SUPPLIES, DEPOTS OF SUPPLIES, WHERE LOCATED AND HOW ADMINISTERED.

The purchase of regular medical and surgical supplies for the Volunteer Army will hardly be delegated to its chief medical officer. These are ordinarily purchased under general regulations of the War Department and laws governing the same. (See Article LV et seq., Army Regulations, also par. 549, 566, 567, 570, 1460, A. R.), but conditions may arise wherein the Surgeon-General may authorize the Chief Surgeon of an Army or an Army Corps to purchase in open market medicines and medical and hospital property to tide over an emergency, telegraphic instruction in regard to the same being requested by that officer.

As stated, under ordinary conditions regular supplies are purchased by officers of the Medical Department, who are assigned to that duty by the Secretary of War. One is now stationed in New York, one in St. Louis and one in San Francisco. In these cases proposals are usually called for and formal contracts made, the purity of the drugs being determined in doubtful cases in the laboratory of the Surgeon-General's office at Washington.

Emergency purchases of medicines, cots, bedding and furniture will ordinarily be an easy matter. Good woven-wire folding cots with wooden frames can be had for about \$1.50 each; cotton mattresses at \$1.40; cotton sheets at 24½c.; pillows at 40c.;

pillow-cases at 9c.; blankets at $2.83; colored quilts at 60c., and pajama suits at $1.00.

The necessary basins, buckets, lanterns and kitchen-ware are all commodities of ordinary trade which can be delivered in any desired lots at points designated.

For the volunteer medical officers, the requisite surgical instruments would either be furnished by the Medical Department on requisition or the officers might be required to take their own instruments to the field.

One thousand Hospital Corps pouches and the same number of belts for first-aid packets could be supplied in sixty days, if they are not already on hand, as they should be. Extemporized pouches and belts might be temporarily provided, a pattern being furnished to each regiment.

THE PACKING OF MEDICINES, ETC.

The proper packing of medicines and medical stores for convenience of transportation and final issue to small commands is a matter to which the purchasing officers should give particular attention. The issue of articles in bulk, in paper packages or boxes or in large glass jars or bottles for field service should never be permitted. Nor should there be defective or removable labels or too large packages, or unmarked packages, for this all creates delay, confusion and ultimate hardship to the sick of an army. Powdered substances should never be issued unless accompanied by proper scales for weighing them and if these are not asked for on the requisition, they should nevertheless be supplied.

The issues of liquid medicines should be made in small bottles, 8 ounces or 250 grams, being the largest, 4 ounces being preferable; the stoppers should be rubber rather than glass or cork, and a spare stopper should be fastened to every bottle. Tablets are an excellent form for issue to troops, but they should always be crushed in a spoon before use by the patient, as they too often pass undissolved through the intestinal canal.

Boxes containing drugs or dressings should never be large or heavy, the preferable size being 12 by 12 by 8 inches, with screw-tops similar to the ammunition boxes of the Ordnance Department.

Every box should bear a stencil label of its contents, a red cross stamp and a U. S. Army Medical Department mark. If it becomes necessary to transport supplies on pack animals, several of these boxes, being of uniform size, could be fastened together with rope or wire straps to make packages of proper shape for that purpose or for transportation by hand carriage or by

litters. All of this may take some trouble and a little extra expense, but it can and should be done.

My personal experience in the difficulties of transportation and distribution of medical and food supplies, to a multitude of separate commands, makes me particularly insistant upon the these points.

The Distribution of Supplies.—The distribution of supplies after their receipt from the main depots should be under the control of the Chief Surgeon of the Volunteer Army and of Army Corps. He should, under direction of the Surgeon-General, establish a large depot at the general point of supplv for that Army and sub-depots for Army Corps as near the locality of their several headquarters as military operations will permit, certain officers of the regular or volunteer service being detailed as acting supply officers, who will fill all requisitions bearing the approval of the Chief Surgeons of Army Corps.

For the supply of Army Corps actively moving, my preference would be for the charter of special cars to be fitted up with shelving and lockers and tiers of cases to serve as traveling storehouses. These cars could be side-tracked near headquarters of the Army Corps, or wherever needed and issues made directly from them to the several corps and division hospitals and also to brigades and regiments.

Before supplies are exhausted, freshly stocked cars should be sent to the front from the main depot, the empty cars being returned to be refilled. Every car should be marked "U. S. Army Medical Department Supplies," and should be in charge of a reliable hospital steward and its point of delivery and schedule of contents should be plainly marked on the outside of each car.

Probably the best style of car for this service would be an "express" or a "postal" pattern. Failing in these, old passenger coaches could be fitted up, the seats being removed and side doors cut. Ordinary freight cars would not be suitable, as there would be no means of access except from the outside of the train.

Water Carriage.—Where water carriage will be required. boats or barges should be fitted for that purpose. Every barge should be supplied with one or more steam or gasoline launches for running up creeks and for towing or landing supplies.

Personnel.—The general medical supply depot should, if possible, be under charge of a Lieutenant-Colonel of the Medical Department. He should be provided with a chief clerk, three assistant clerks, a chief packer and a sufficient number of assist-

ant packers and laborers to handle the supplies and prepare them for shipment.

Contracts for furnishing all the boxing required could be let in any city at reasonable rates.

When a medical supply train is formed, it should be under charge of a medical officer of the Army who is acquainted with such work; also a hospital steward, two acting hospital stewards and ten Hospital Corps men as packers, laborers and guards, subject to railway conditions. The running of this train should be under the charge of the Medical Department, including its conductors, crew and motive power.

Medicine Wagons.—It is an open question what style of medicine wagon should be adopted. So far as I know there is none now in service, and those used during the Civil War had many drawbacks which led to their abandonment. It is my belief, however, that if medical stores are packed in the manner already described, almost any vehicle will answer that purpose for general work. For regimental service the present medical and surgical chests are fairly satisfactory and they are better adapted to all sorts of exigencies than any medicine wagon. In certain surgical appliances the chests are lacking, such as a sufficient number of splints, cloth dressings and bandages, but during the war with Spain this deficiency was met by the issue of chests of special pattern containing everything needed in that line for use either in regimental or field hospitals.

One medicine wagon at least should be assigned to every brigade surgeon and one to every field hospital as a reserve. From these wagons the field chests of the regimental medical officers can be restocked. It is intended that these traveling store-distributors shall be rapidly refilled at the corps medical railway train and sent to the front as needed, a few surplus wagons, ready packed, being kept on hand to take the place of the empty ones returning. These wagons should form a part of the ambulance train and be under the control of the chief surgeon of the corps.

Attached to each wagon should be an acting hospital steward, who would receive and issue the supplies, and be responsible for their care and safe keeping.

IX. Convalescent Companies and Camps.

An essential adjunct to the hospital system of the Volunteer Army would be the formation of convalescent companies and camps, to which should be sent all officers and soldiers discharged from general hospitals as only partially fit for duty. This will

relieve the hospitals of their great burden of the half-sick who occupy beds that should be for others.

All these camps should be under the control of the Provost Marshal of the Army, a Lieutenant-Colonel or officer of less rank being in command with a sufficient number of officers and men to keep the men in order. Here they can resume their camp life, being given suitable drills and other exercises to build them up, so that they can be ultimately returned to the ranks. Transfers of these men should be made from the rolls of the field regiments, so that their places can be filled with fresh troops. Those who are unfit for further service should be discharged on surgeon's certificate of disability, preferably after examination by boards of medical officers detailed for that purpose.

During the Civil War medical inspectors were delegated to prepare certificates of disability for discharge in these cases, and given authority to formally complete such discharges without reference to higher authority.

X. BURIAL OF THE DEAD.

This last and sad disposal of our patriotic soldier, under present regulations, is under the control of the Quartermaster Department of the Army, as is also the registration of the graves and care of cemeteries.

The identification of the dead is among the duties of the medical officer under whose charge they may be, especially at all military hospitals, in order that the death records may be properly prepared.

Identification of the dead upon the field of battle, by examination of all bodies that are found and the registration on outline cards of all marks and scars discovered, has been proposed by certain enthusiastic admirers of the system, but in the hurry of an active campaign, any such attempt would result in a flat failure, and anyone who has sufficient experience in the preparation of these cards in large numbers, as a part of the enlistment service of the Army, will bear me out in the statement.

The German method of fastening about the neck of every soldier a brass tag which bears a consecutive number of an indefinite series, is much more simple and absolutely certain unless a soldier loses or trades his tag. Such loss or substitution could easily be detected and corrected at any company inspection after a battle, the identification being arrived at by the process of exclusion.

REMARKS.

The necessary limits of this paper prevent me from referring to several important and interesting matters which at some future time can be treated in detail. These would comprise an enumeration of the specific duties of the several officers of the Medical Department, from the Surgeon-in-Chief of the Army down to a junior assistant attached to a regiment or smaller command; also the several duties of the non-commissioned officers of the Hospital Corps; the specific nature of the medical and subsistence supplies that would be required for field and permanent hospital, also for small moving commands; the utilization of private vehicles for transportation of the wounded in the possible absence of a sufficient number of ambulances; the character of those best adapted for the purpose, where they may be procured whether by purchase or hire or seizure; the establishment of dressing stations on or near the field of battle, their lines and methods of communication with the field hospitals and fighting line; the best methods of caring for the wounded who must be left on the ground where they fall; the advisability of litter carriage under heavy fire from the enemy and how it can be best accomplished. All of these and many other subjects germane to that under consideration must be postponed for future study.

XXVII. SOME OF THE TRIALS AND TRIBULATIONS OF A MEDICAL OFFICER OF THE UNITED STATES ARMY.

BY

MAJOR WILLIAM O. OWEN,

SURGEON, U. S. V., FORT THOMAS, KENTUCKV.

About November 30, 1898, I was sent with the Hospital Corps under my command from Manila, P. I., to Corregidor Island, at the mouth of Manila Bay, to construct a one-hundred-bed hospital at that point.

On my arrival there I found the old Spanish naval station to consist of the house formerly occupied by the officer in charge, the barracks, two houses formerly occupied by employes, the hospital building, a boat-house, a blacksmith shop and a kitchen (an octagonal building about eight feet in diameter).

In the village adjoining I found two school-houses, a jail, a church, and the house of the priest. These I proceeded to seize with my fifty or more men, and house my property as best I was able. The commanding officer's house I used as officers' quarters and mess; the barracks I converted into a ward and linen room, a medical store-room, a dispensary and a dental office. One of the employes' houses I converted into quarters for non-commissioned officers; the octagonal house into a store-room for the kitchen, which latter was placed under a paulin, and the boat-house was converted into a dining-room, the end and side to the north and east of which were closed with a paulin so as to prevent the sand from being blown over the men's food. The north end had to be built up about two feet to keep the tide from flooding this room. Boxes were carefully unpacked, taken apart and the pieces made into dining tables, benches and cupboards for dishes. The school-houses and jail were made into officers' wards. The church had the altar and ten feet in front of it partitioned off for the worshippers and the remainder was extemporized as my main store-room. As much of the priest's house as was fit was made into a laboratory. The old hospital building was converted into a store-room for my commissary stores, but it was so low and damp as to be unfit for that purpose. One of the houses was in such miserable shape as to be useless.

When we first arrived the entire grounds were covered with

weeds, vines, banana plants, etc. All of these had to be cut down and removed before we could set a tent. After much trouble and labor the tents were set for the Hospital Corps men, then the tents for use as wards were set, prepared with bedding, etc., and when complete the sick were brought down and placed in them. This had been completed scarcely a month when I was ordered to increase the capacity to 200 beds. This being done, I was allowed about two weeks and then was ordered to increase it 100 more, which was done at once.

In landing the material for the first hundred beds I experienced so much difficulty that I determined to make a wharf for the proper landing of stores, etc. This was accomplished in the following manner: After much search for material, I discovered an old scow—the so-called cascoe of these islands—buried in the sand. I took the bottom and sides of this for material from which to construct my wharf. The sides of the scow were about 4 feet wide, 35 feet long and 4 inches thick. I placed two 8-inch logs, 5 and 6 feet long, on end at the edge of the water and secured them by rocks and cement in two barrels, then spiked the two sides of the scow to these with 8-inch spikes (which I found in the blacksmith shop), leaving about 6 feet of the sides projecting over the water. On these two ends I placed an 8 by 6 log, secured by ¾-inch iron. I then fastened on top of the two uprights a 12 by 8 log. The shore ends of the sides were secured together by fastening a plank 2 feet wide, 6 feet long and 4 inches thick, to the ends. The solid bottom, which was about 50 feet long, from 4 to 5 feet wide, and 4 inches thick, was then placed on top and made fast to this framework. The curve of the bow was used to climb the short, sharp incline of the embankment. When this was finished the entire crib was filled with the heaviest stones I could secure, using the largest of these for the side next the water, as a very heavy sea washed this point, often coming over the wharf in large solid masses, which carried away all stones less than 150 pounds in weight. This gave me six feet of water at low tide, so that the small boats could land without trouble. To enable them to do this, I procured a large buoy, which was anchored off-shore in about 30 feet of water, so that the bow of the boat would be made fast to the wharf while the stern would be made fast to the buoy.

The question of obtaining a sufficient supply of water was solved as follows: At the start we were dependent on a well and a spring, furnishing respectively 600 and 300 gallons per diem. This being inadequate to our demands, we were forced to look further to obtain a sufficient supply. After a careful search

of the mountain back of the hospital and a short distance from the light-house which was on the summit of the island, a small stream was found springing from the sandstone, which gave in the dry season of the year about 10,000 gallons per diem. At this point the gorge was not over 15 feet wide between the rocky walls and here, at an elevation of about 150 feet above the hospital and from half to three-quarters of a mile from it, a dam was constructed from large boulders, the crevices being filled with clay. From this point a 1¼-inch pipe with a drop of 1 foot in 40 was then laid, using a miner's level as a guide until the exact point at which the drop into the hospital grounds would occur was evident. The reason for this was that no engineering instruments were to be had whereby this line could be located accurately.

The underbrush was so dense that it was impossible to see at any point even 50 feet ahead, and there was scarcely a foot that did not require the use of the axe and the knife to enable the pipe to be passed. At one point there was a gully 20 feet deep and 150 feet wide. To enable us to reach the hospital grounds with the pipe which we had, it became absolutely necessary to cross this gully in a direct line. This was accomplished by passing the pipe up into the trees and securing it at the required level with heavy wire.

After the pipe reached the hospital grounds, it first cast off a branch for the shower-baths which were arranged as follows: A platform was built over a large cemented ditch, the pipe extended over this platform properly spaced by T's, with six ordinary cut-offs—for I could secure only one or two faucets, while cut-offs were in plenty—and beneath these cut-offs tomato cans were hung, the bottoms of which were full of nail holes, thus constituting shower baths. The pipe then continued on to the stationary, stone wash-tubs left by the Spaniards, where the hospital laundry work was done by four Chinese. The main line then continued on, giving a branch to the dispensary and one to the condensor, finally ending at the kitchen.

For drinking purposes I had a still capable of producing 1,000 gallons of distilled water per diem, and a 300-gallon tank to receive this water. Each night this tank was brought to the boiling point by steam from the boiler. The water was then distilled until the tank was full. This arrangement gave the hospital a supply of pure and palatable drinking water.

There was also a sterilizer, 7 feet long and 40 inches in diameter. This had already been used at the Presidio of San Francisco, Cal., to disinfect a very large number of tents, beding, etc., which had been used in the infectious wards at Camp

Merritt and at the Presidio, and it saved many times its cost in material which must otherwise have been destroyed.

After the large accumulation resulting from the first clearing-up, I used as a destructor for the hospital waste, such as old dressings, poultices, etc., and the collections of leaves, grass, etc., from policing the grounds of the hospital, an old lime kiln which was close to the wards. Into this the nurses and policing party had instructions to throw refuse of the character mentioned. When the kiln was full a fire was built under it, coal oil thrown on it, and it was fired until completely burned out. The ashes were then taken off-shore and thrown into the sea.

The method of disposing of excreta was as follows: Five-gallon coal-oil cans were taken, the tops cut out and the edges flattened; on each side of the can was then nailed and riveted a piece of inch board, the lower side being beveled on the inner edge for use as handle. An open-sided crate, with an ordinary privy seat for a top, and a bottom so built as easily to admit the can, was then made. For each of the twelve crates which we made, I had three cans prepared; each morning and evening at 6 o'clock such of the cans as had been in use were removed, taken off-shore in a boat, emptied half a mile out at sea, the cans well washed in sea water and afterward placed to air for twenty-four hours. The old blacksmith shop was converted into a place to use these cans, and all excreta were covered with dry, powdered clay as soon as discharged. The result was that there was scarcely an odor in this room. I used an iron pan, six feet square and one foot deep to dry this earth. I was compelled to choose between coal-ashes, sea-sand, or clay. I chose the clay as best suited for the purpose. This was dried at as low a temperature as possible.

The kitchen refuse was at first thrown from the end of the wharf, but I soon found that this was soiling the wharf and also the beach, and it had to be discontinued, and the refuse was taken to sea in a small boat and thrown overboard. It was very curious to see how soon the fish learned to know at what hour the man would appear at the wharf with his wheelbarrow load of refuse, and they were always on time in large numbers.

The Spanish kitchens at this naval station were very curious and interesting to me. They were simply a solid stone shelf about 4 feet high, upon which another shelf 4 inches high was built, and in this were triangular openings a foot wide in front, about 4 inches wide at the inner end and a foot deep. Over these were placed round rings, or bars, on which rested the cooking utensils. A fire of charcoal or wood was built in these triangular openings. The smoke from the fires drifted as the

wind blew, no provision being made to carry it off except an overhead hood.

The cooking at this hospital, which was officially known as the Convalescent Hospital at Corregidor Island, was for one month done on open fires in three Buzzacott ovens. Later, three large ranges were provided. These were all placed under a large paulin adjoining the octagonal building, and paulins placed on the sides to protect them from wind and rain.

The amount of sand and dust which will accumulate in food cooked in the open in this way will astonish anyone who has not experienced it.

The tents, about 100 in all, were floored as follows: The floor space was divided into three parts, the two outer having separate floors made for them, while the center remained bare, thus giving four beds to the tent and allowing room in which the patient might dress himself on the floor beside the bed. The reason for arranging the floor in this manner was this, it left less space in which decomposing matter might collect; air could circulate more freely under these narrow floors, and it saved much time and labor, for these small floors could be removed rapidly, the ground cleaned, the floor replaced by four men and the tent left undisturbed. With large, solid floors, on the contrary, air cannot circulate freely, decomposing matter certainly collects, and the floor cannot be removed by less than 10 to 12 men, and often in so doing the tent is almost dismantled. The large floors must be placed before the tents are set, if they are to be put in a row, but with small sectional floors the tents can be placed in as long a row as is desired, the sick cared for and the floor put in as the opportunity presents itself.

The best method which I found of putting in a line of tents was to put two tents end-to-end, then to leave a space the width of a tent, to cover this with a fly, and to then place two more tents end-to-end, and so on. This is not only more convenient, but adds materially to the comfort of the nurses and sick who occupy the tents.

The men of this detachment also built a very large bake-oven for the use of this hospital. It was more than ten feet long and five feet wide, and was very well built of brick. This work was chiefly done by Private Weifels, who seemed to be able to turn his hand to anything.

The dental office was in charge of Private William H. Ware, a dentist by profession, who was vouched for by the dean of his college as a competent man. This, so far as I am aware, was the first dental office ever fitted out officially by the United States Government.

The laboratory was in charge of Private F. N. Smalley, a graduate chemist.

The carpenter work was done by Private Zander, the only one in the detachment who understood this work.

The dam for waterworks and the entire pipe-line, the engineering of the aqueduct across the ditch, etc., was the work, almost entirely, of Privates McDuffy and Pinkerton.

Had it not been for the cheerful and intelligent work of every member of this detachment, among whom there was scarcely a laggard, I fear that this place would have remained a wilderness, but they one and all gave cheerfully long hours and diligent, skillful toil, and the result was that in a short time a flourishing little village under canvas had sprung up from this vast and unbroken solitude of tropical brush and vine.

Lieutenant Henry Page, Assistant Surgeon U. S. Army, and Dr. E. K. Johnstone, Acting Assistant Surgeon U. S. Army, of San Francisco, Cal., were my constant companions and assistants from the commencement of these trials and tribulations and what success I had was in great measure due to their constant, thoughtful care of the many duties which fell to their lot.

Fort Thomas, Ky., April 30, 1900.

XXVIII. THE AMBULANCE COMPANY, FIRST DIVISION, THIRD CORPS.

BY
MAJOR JOHN VAN RENSSELAER HOFF,
SURGEON, U. S. A., FORMERLY CHIEF SURGEON, 3D CORPS.

For a generation the Army of the United States, small in numbers and scattered over vast areas of territory, acted as the advance guard of civilization in our country. During this period the medical field organization was of the simplest character, based on the requirements of a few men, and was not hampered by the necessity for careful interior organization. A single surgeon, possibly a hospital steward, a medicine pannier, a case of instruments, and a tent met all the indications that the service then demanded.

In this school there grew up a body of medical officers, self-reliant, active, ready for emergencies, fearless of all danger, but not trained in the extended organization necessary in large aggregations of troops operating in armies. Let it not be understood for a single moment that the Medical Department failed to appreciate the necessity for such training; let it not be thought that it had forgotten the wonderful lessons of the War of 1861-1865, in which, through sad experience a hundred times worse than that of the Spanish-American War, it had reached perfection and gained the approval of the world. All these lessons were fully appreciated, but the opportunity for their practical application had been denied the generation of medical officers who to a large extent had to face the administrative demands of the Spanish-American War. Carrying out the very practical, but, in military matters, dangerous American principle that it is not desirable to climb the fence before we get to it, the Army had apparently forgotten that its functions would ever become different from those of a frontier police, and as a consequence its organization for the larger purposes of war had been neglected. The Medical Department was no exception to the rule which applied to every other department of the Army, and when the Spanish-American War precipitated itself upon us, it was found that there was practically no regulation covering the organization of the Medical Department for war service. It may therefore be said that what organization resulted in that war was the offspring of immediate necessity, and it may also be said

literally that such as we had was born in the presence of the enemy and under his fire.

In a previous paper by the writer (see page 106, Vol. VIII, Proceedings of the Association of Military Surgeons of the United States), a resumé is given of the problems which then presented themselves for solution by the Medical Department. At various points in the United States great camps of instruction were established. As the name implies, the primary object of the aggregation of troops in these camps was to teach them their duties, so that they might learn, not as individual soldiers, but as an aggregation of soldiers, their relation not to the right or left file of their company, but to neighboring companies, regiments, brigades, divisions and corps; to give them a sense of proportion which their previous training (if they chanced to have had any military training) had never afforded. The Medical Department was not less in need of this training than any other branch of the service.

It must be remembered that there is but one point of contact between the physician in the Army and the physician in civil practice, and that is the patient himself. It needs but a moment's thought to be convinced of this fact. Let any physician recall his common, every-day experience in his routine of practice in city or town, and compare it with the experience that he had in the service, should he chance to have been in the service, and the difference is at once appreciated. The physician in private practice as a rule finds his patient upon his first visit comfortably housed and resting in a comfortable bed. After the usual examination and diagnosis, he writes a prescription which is to be filled at the neighboring pharmacy, and if necessary sends to the nearest agency for a trained nurse. He directs a dietary which is prepared in the kitchen of the patient's house, gives such other directions as the case demands, and proceeds to his next case, which he finds under exactly similar conditions. But the medical officer finds his case under the stress of military life, unsurrounded by any of the comforts of home, probably lying in the mud and mire, unprotected from storm and from the vicissitudes of the weather. He must build the house, usually a tent, in which his patient is to be treated. He must obtain the bed on which he is to lie. He must train the druggist who is to compound the prescriptions that he orders, from the drugs that he himself has gotten. He must train the nurse to whose care the patient must be committed. He must train the cook who is to prepare the dietary. In fact, he must look after every material want of his patient, in addition to the professional care that he is required to give him.

Not only must he look after the material wants, but he must even look after the personal business of the patient, must keep his accounts, must see that he is supplied with clothing, that he is regularly paid, and must attend to the thousand and one things that an officer is required to do for the soldier, entirely irrespective of his relation to him as a physician.

The Third Corps was organized in Chickamauga Park during May, 1898. Its commissioned and enlisted personnel was admirable as to the individual, but absolutely crude as to its military aggregation. The number of experienced soldiers could be counted on the fingers of two hands, and in the beginning there was scarcely a single medical officer who had the most remote conception of his duties as such. It was believed that the camp was to be, as its name implied, a camp of instruction, that all the officers and men were to be inducted into the theory and, as far as may be, into the practice of their new profession. But theory was to be by far the greatest part of the instruction. Realizing how much instruction our excellent physicians needed before they could become even passably good medical officers, on the organization of the Medical Department of the Corps as outlined in General Orders No. 58, May 31, 1898, a systematic course of instruction was inaugurated, the object of which was two-fold: First, to teach the medical officers their duties; second, to make efficient the units of the divisional medical organization.

But not only had we to teach the medical officers, but the enlisted men of the Hospital Corps as well had to be trained in the performance of their important duties. The divisional field hospital and ambulance company were the two important factors in this instruction. In the first, the officers and men were instructed in duties which were more closely of a professional character; in the second, they were instructed in duties which partook more of a military character.

The object of this paper is to make a brief record of the organization, interior economy, management and methods of instruction of the ambulance company, First Division, Third Corps, which may be regarded as a model for all similar organizations.

It will be recalled that Congress made no provision for a Hospital Corps in the organization of the Volunteer Army, and this important corps had to be improvised under the stress of dire necessity. This was accomplished by the transfer from the volunteers to the Hospital Corps of the Regular Army of a certain number of men, willing or unwilling, fit or unfit. It mattered not that such transfer was illegal, as was ultimately so

decided. It was a necessity which knew no law, and which could be met only in this way.

Thoroughly appreciating the necessity for an adequate number of men of the Hospital Corps, General Wade, then commanding the Third Corps, ordered the transfer of an adequate number of men from each regiment, which transfer was accomplished in a few days, and the Medical Department of the Corps was put in control of nearly 500 men whose duty it was, under the provisions of the law organizing the Hospital Corps of the regular establishment, to perform "all necessary hospital services in garrison, camp, or field, including ambulance service." The organization outlined in General Orders No. 58, May 31, 1898, was followed literally, a due proportion of men being assigned to the different medical elements, of which the ambulance company received 114. Seven of these were regimental hospital stewards of volunteers, who constituted the non-commissioned officers of the organization. These were admirable men, accomplished pharmacists, but without any knowledge whatever of the special duties of the hospital steward, and with little or no aptitude for the control of the 107 privates who were under their immediate charge. Six medical officers were assigned to this company, two of them permanently attached, one as commander and one as executive officer. Major John L. Macumber, Surgeon of the 14th N. Y. Volunteers, who for some time previous to the war had been in the National Guard service with this regiment, and who was a man of great physical activity and adaptability, was selected as the commander, and Captain J. S. Kulp, Assistant Surgeon, U. S. Army, was assigned as executive officer of the company.

It was intended in the organization of this company to temporarily attach in succession all of the medical officers of the division, so that they might get some idea of the military control of men and of the interior economy of military organizations. This plan was not carried out to the fullest extent, owing to the fact that in a few weeks the camp at Chickamauga became, instead of a camp of instruction for soldiers, a vast hospital, and every effort of the Medical Department had to be devoted to the care of the actual sick on the camp-ground instead of preparing, by theoretical instruction, to care for the hypothetical wounded on the battleground of the future. Nevertheless, much excellent work was done in this company, and a considerable number of officers learned through its instrumentality much of military methods of which otherwise they would have remained ignorant.

The function and equipment of this company are set forth

in detail in a paper which I had the honor to present to the Association of Military Surgeons of the United States, which is published in the Proceedings of that Association, Vol. VIII, page 116, et seq., and it will not be necessary to refer further to these in this paper.

The theoretical training of the company was directed to its preparation for active service, especially on the field of battle. The actual work consisted in attendance on the numerous ambulance calls which were made from every organization in the division, for all the ambulances of the division were concentrated in this company.

The interior economy of the organization was identical with that of a light battery of artillery, and it was my desire that the very high standard maintained by the light batteries in our service should be that to which the ambulance companies should aspire. It will be recalled that the ambulance company had 25 ambulance wagons and 4 army wagons, with 66 draft horses, in addition to the 14 or 15 saddle animals used by the officers and non-commissioned officers. These wagons and animals all had to be cared for by the men of the company, and the most careful supervision was necessary in order that the transportation should be ready at all times for the work required of it. Only a man who has been made responsible for such a large number of animals can appreciate the constant demands made by them in many directions. Not only was it necessary to teach the men the care of animals, but they had to be taught how to drive them. The wagons required constant supervision, and the company required the constant services of a blacksmith and a wagoner. This was but one department of the organization. The instruction of the men in their technical work as sanitary soldiers; first-aid; the lifting and transportation of wounded by hand and litter; the transfer of wounded from litter to ambulance and vice versa; the training of the men in the simple military maneuvers necessary to move them with celerity and order, the teaching of discipline which is a *sine qua non* to all military organizations; the instruction in the duties of the company housekeeping, cooking, care of tents and grounds; the selection of men who developed a special aptitude for the various offices of the company, charge of the company records, charge of the company property, charge of company mess, charge of corral, charge of police, the thousand and one things that a hundred men require to have done for them, no matter under what conditions they are placed, occupied the time of all officers, and especially of the executive officer, who was tireless in his efforts to improve the organization.

While all the officers assigned to this organization did their duty faithfully and well, it is essentially indebted to Captain J. S. Kulp, Medical Department U. S. Army (now Surgeon U. S. Volunteers), for the excellent results obtained in such a comparatively short time. Captain Kulp possessed qualities which peculiarly fitted him for the organization of such a command, and his experience as an officer of the Army had given him a knowledge of military methods which were indispensable to the work he had in hand. Everything in this organization was clean-cut, systematic, in accordance with regulations, and evidenced an experienced directing hand quite in contrast with neighboring military organizations. The methods of instruction were simple but persistent. The men were required to be busy all the time during their waking hours. The greatest attention was paid to their creature comforts, but they were required to give their best efforts to the work in hand. The discipline was strict, as of necessity it had to be in a company of recruits. Punishment quickly followed an offense, but it was made to fit the crime, and the men recognized its justice.

This organization existed three months. It was not given an opportunity to display its usefulness on the battlefield, but I feel very well satisfied that had it been called on to meet this supreme test of the value of military organization, it would not have failed.

XXIX. SOME SUGGESTIONS ON RECRUIT IDENTIFICATION AND ROUTINE CORRESPONDENCE.

BY

CAPTAIN JOHN S. KULP,

ASSISTANT SURGEON, U. S. A.

Time, from an Army standpoint, consists of but two periods, peace and war. In the former the pen is mightier than the sword, as may be seen by their relative sizes on the insignia of the Judge Advocate-General's department. In the latter period the brawny muscle cell triumphs over its superior officer in the brain, and paper work languishes. The Medical Department is justly proud of its simple and complete system of information, and the following remarks are not adverse criticism, but merely suggestions looking toward economy of work, and of time.

For a small army in time of peace, no better system of identification than the outline figure card can be imagined. For a large army in time of war, it is believed to be unnecessarily elaborate, too expensive from the standpoint of time, and ununiform because of its large factor of personal equations. The explantion of the preparation of the figure card consumes four pages of the manual for the Medical Department, and the requirements of Paragraph 185 have fallen into innocuous desuetude. It is unnecessary to speak of most of the disadvantages to those medical officers who conscientiously prepare these cards, but the item of expense is interesting.

The labor of its servants costs the Government money in proportion to the time consumed, the rank of the workers, and the conditions under which they work. A Captain and an acting steward taking twenty minutes to make out a figure-card means thirty-one cents for their pay while doing it, besides the use of more highly skilled labor than the work demands. The clerical force necessary in order to copy and to classify adds expense, so that the system has been already abandoned so far as the volunteer forces are concerned, and an increased army will be a shock to its vitality.

Another time and stationery consumer is the long and oft-repeated, nominal designations of men. For statistical purposes it is a matter of indifference whether John Doe or Richard Doe is afflicted. An observer of the records of the department cannot fail to remark the amount of space appropriated by the name,

rank, company and regiment, for instance, "Edward J. Johnsen, private, J troop, 7th U. S. Vol. Cavalry," while on the reports of sick and wounded are long columns of the many-times written word "Command," meaning direct from his organization.

Depending on the taste and fancy of the speller, Edward J. Johnsen, Ed. Johnson, E. J. Johnsen, or E. Jerico Johnsen may, or may not, refer to the same person, leaving out of account the white man's burden of illegibility, or the same applying to several men. A possible remedy will be suggested later.

The principal requisites for a system of identification are (a) facility of reference, (b) ease of application, (c) simplicity, (d) security of identification, (e) absence of cumbersome appliances, (f) the relative elimination of the personal equation, and (g) the question of time.

A plan which possesses some of these and which seems to have advantages over the figure-card system consists, in brief, of standing the recruit before a chart plotted off in square feet and square inches, and taking a photograph. Every linear measurement of his body can then be plotted with ease.

The apparatus required consists of a sheet of muslin, six-and a half feet square, stamped in squares (figure 1), and having a black space on it for the recording of data with chalk. The camera for the sake of uniform results, although not of necessity, should have a fixed focus, an automatic exposure, a narrow angled lens, and should carry a roll of film for five by five-inch negatives. The cost of such a camera should be rather less than five dollars. The chart and the camera, with the addition of a piece of chalk, comprise the impedimenta.

To apply the system we do not ask the man to look pleasant, any more than we ask his permission to "claw" all over him for a figure-card. The non-commissioned officer places him in the proper position, and writes on the black space, "Edward J. Johnsen, PJ7C4216, 2-21, 1900," over the signature of the examining surgeon.

The first letter stands for the rank, the second for the company, the first numeral for the regiment, the letter following for the arm of the service, followed by the individual regimental number of the man. Whenever the man is referred to on the records of the Medical Department he is known as PJ7C4216, and unless notation to the contrary is made he is received directly from his command. In regard to this individual number, all recruiting officers could be allotted certain numbers from the Surgeon-General's office, according to their needs, just as the numbers on commissary checks are never duplicates. The same number would be placed on the descriptive and assignment card

to be transferred to the descriptive list for reference. This system is in successful use in the British service.

When our friend becomes ill, or is man-handled by his intimates, it would be much simpler to place his number (which stands for name, rank, company, regiment, branch of service, and the date of his enlistment), on a suitable card with the requisite data, and forward it at the end of the month to the office of the Surgeon-General for a card index, than to use our present Report of Sick and Wounded (Form No. 25).

All this time the man has been standing before the chart. Twelve feet before it is the camera, six by six, by seven inches in size, whose only don't is its request to avoid pointing it at windows. The assistant has written on the black space with a piece of chalk, the name, number, nosemark (whether the bridge is straight, convex, or concave), and the date. The recruiting surgeon presses the button, the automatic shutter opens, exposes for two seconds, and then closes again. He then turns the key until a new number comes into view, and the whole work is done.

Let us follow the film. After one or more exposures, or at the end of the month, the film is put into the same box in which it came, and is sent by mail to the central office. Here it is developed and a print is made *directly* on a 5 by 5 card of etching matte. Dr. Millen has now so perfected this paper that it requires no developing, toning or fixing baths, all that is necessary being its immersion in water. There is no copying at all.

The card is now placed in the card index, which is divided according to four or more headings. Those recommended as the result of experimentation are the distance between finger tips, the line of the bridge of the nose, the height of the umbilicus, and the height of the nipple. Many other subdivisions are at our service should they be found necessary.

The reference would be simple. Suppose that we wished to compare a card made in 1903 with one made in 1900. It is seen at a glance that the extended arms measure 69½ inches, there may be say 500 cards under this measurement. The card shows that the bridge of the nose is concave, and this eliminates two-thirds of them. The umbilicus is 39, which reduced the number to about 40, and the nipple being 51, leaves but a half-dozen. A glance at these show whether or not one of them is a corresponding card. If we find that Mr. Adolph VanR. LeClaire bears an unmistakable resemblance to our friend Mr. Johnsen, who deserted in 1901, we have proof of theosophic transmigration.

FIGURE I.—A muslin sheet six and a half feet square, ruled in square feet and square inches. Folded chart and camera are shown on right.

FIGURE 2.—The completed chart ready for filing. The measurements in this case are 69½, ⌣, 39, and 51.

FIGURE 3—A man having the same height as the one shown in Figure 2. The variation in the filing measurements is very apparent, figure 2 being 69½. ⌣, 39, and 51, while those of figure 3 are 66½, ⌢, 38, and 49. (Blackboard was left unchanged from preceding figure).

XXX. THE SKI, AND ITS USE FOR MILITARY PURPOSES IN YELLOWSTONE NATIONAL PARK.

BY

CAPTAIN ALFRED E. BRADLEY,

ASSISTANT SURGEON U. S. ARMY, FORT SNELLING, MINNESOTA.

In Norway the ski has been in continual use for military purposes from the days of King Sverre—1184-1202—down to the most recent of the border struggles with Sweden; in the middle of the eighteenth century special companies were organized and kept well trained in its use, though I have been unable to ascertain just what this training was, or the character of the duty required. It is said that some of the Norway militia are at the present time provided with ski, but this I cannot verify.

It may not be very generally known that for more than one-half of the year certain United States troops rely on the ski as their only means of transportation, but this is a fact concerning the troops stationed in Yellowstone National Park. This region is 3,312.5 square miles in area. In addition to the park proper there is a large territory to the east and south reserved for settlement, set apart as a Forest Reserve, which is also under the charge of the Park Superintendent to some extent, making the total area under the protection of United States troops more than 5,000 square miles. Two troops of cavalry have constituted the guard for this vast region, but since the Spanish War one has had to suffice.

The wonderful natural features of this region are well known to the public, but it may not be a matter of common knowledge that this is the greatest game preserve in the world.

As to the topographical features of this region, the following brief description must answer the purposes of this article: This region is crossed by the Continental Divide irregularly from about the middle of the western boundary to the southeastern corner, the greater area being on the Atlantic slope. This slope is drained by the Yellowstone River and the headwaters of the Missouri; the Pacific slope is drained by the Snake River. Very many lakes and small streams are scattered throughout this region.

The great portion of the park is composed of plateaus varying in altitude from 7,000 to 8,500 feet. Along the eastern boundary extends the great Absaroka Range, bleak, rugged, for-

bidding mountains, furnishing some of the grandest scenic effects of this whole wonderful region, and forming a natural barrier to intruders. To the north and northeast is the Gallatin Range, of which Electric Peak is the highest in the park.

At Fort Yellowstone, Mammoth Hot Springs, Wyo., altitude about 6,300 feet, where it was the good fortune of the writer to be stationed several years, weather observations are kept by the Surgeon. Hardly a month of the year passes without freezing temperature, the maximum temperature rarely reaches 88° and then for only a short period about mid-day, and the nights are invariably cool.

The precipitation at Fort Yellowstone ranges from 15 to 20 inches, the greater amount during the winter; the snowfall here varies from five to ten feet, but on the park plateau where no accurate observations have ever been kept, it is very much greater.

The park season for tourists is supposed to begin June 15, but often the snow remains to such depths as to seriously interfere with travel, and it is frequently near the first of July before the complete tour of the park can be accomplished. It can readily be understood that with such accumulations of snow, ordinary methods of travel would not be practicable in winter months. The question naturally arises "Why travel at all during this season?"

The National Park Protective Act has this preamble: "An act to protect the birds and animals in Yellowstone National Park, to punish crimes in said Park, and for other purposes." In Section 4, "That all hunting or the killing, wounding, or capturing at any time of any bird or wild animal * * * is prohibited within the limits of said Park." By this act was the park made the greatest game preserve in the world, and under the provisions of the Sundry Civil Bill for 1883, troops have been detailed "To prevent trespassers or intruders from entering the Park for the purposes of destroying game, etc."

Here are to be found the elk, deer, antelope, mountain sheep, a few buffalo, the moose, beaver, mountain lion, wolverine, bear, lynx, wildcat, marten, fox, mink, otter, coyote, wolf, porcupine, mountain marmot, badger, etc.

To obtain the valuable furs of some of these animals, to secure the heads of others, which as game trophies have become rare and valuable, and to procure the flesh of still others for market purposes, many unprincipled men will and do deliberately violate the law. During the winter season such lawlessness can best be conducted, and it is at this time that the utmost vigilance must be exercised by the troops. Frequent inspections must be

made, particularly in the regions where game is known to exist and range.

Consider the great area to be protected and the limited number of men available, and it will be appreciated that much traveling is necessary to make the essential patrols.

A snowshoe of some sort is the only means by which such travel can be accomplished, so the ski has been selected as the best adapted for our cavalry on detached duty in the park during the winter months.

The name of this implement is, in that locality, pronounced as though spelled "skee," which, by the way, is the spelling adopted by some writers; the correct Norwegian pronounciation is in sound almost identical with the English word "she."

In Nansen's delightful narrative of his trip across Greenland he frequently uses the words "skilöber" meaning snowshoer, and "skilöbning," snowshoeing, formed from the Norwegian verb "löbe," to run. He gives the plural "ski" as "ski" or "skier;" in the vicinity of the park "ski" and "skis" are used as the plural, and we speak of "skiing," or "snowshoeing;" as the web shoe is never used in the park there is no confusion in the meaning; but in the work alluded to, Nansen often had to speak of both the web shoe and the ski; the use of the former he designates "snowshoeing," of the latter "skilöbning."

The snowshoe in the broad sense, is a device adapted to sustain one's weight while traveling on snow, and in the regions where the snow lies deep over the ground for many months of the year, it is absolutely necessary to the welfare of the inhabitants. It has been said that, in association with its kindred implement, the sled, the snowshoe was the apparatus for most rapid land transit known to man before the age of steam.

It is interesting to trace its history and development; man's ingenuity early led him to devise implements adapted to aiding progress through snow. A simple disc of wood might prevent the feet from sinking into the snow, but would retard progress if of any size; so to obtain sufficient bearing surface, the tendency was to make the device oblong. To lighten the device, a wicker framework might be substituted, and the elegant Indian web shoe be eventually the result; or the wooden device may have been made thinner and strengthened by a covering of hide, and as the hide retained its hair, no doubt the advantageous sliding motion was soon discovered, and the transition from plates to the slender ski was the result. In some parts of northern Asia ski now actually in use are exceedingly broad and short, and skis covered with skin are still universal over the greater part of this same region; this was probably the form used by the Lapps,

and in Norway down to historic times. In the eastern valleys of southern Norway and the neighboring Swedish districts, a transitional form is even now in use, one ski being long and of plain wood, the other short and covered with skin.

Nansen says that "The woden snowshoe as used to-day varies from people to people, but there are really but two kinds: the ski proper, or wooden skate used in rapid transit, and the compound ski, lined beneath with pelt, useful in draught and also in uphill work. The smooth ski is seen in two forms, one having grooves beneath, acting as a keel or keel-board, the other being perfectly flat and smooth."

The same writer describes the ski used in Norway as a strip of hard wood from five to six feet long, four or more inches in breadth and, on the average, not more than an inch thick; many of them are ornamented and they are pointed and turned up at both ends, having a strap in the middle for the foot: on the under side there may be a groove. This describes the type found in Norway, Sweden, Finland, Russia and on the Amur.

This writer concludes from his investigations, that skilöbning is an old sport in Norway, but history fails to trace it to its origin. From Norse legends there seems little doubt that the use of the ski was learned from the Lapps and was generally practiced at least as early as the tenth century in northern Norway. On philological grounds he has traced the source of the ski to the region about Lake Baikal and the Altai Mountains, which region is generally accepted to be the common origin of many peoples and tribes scattered throughout northern Europe and Asia. The same word, or word-type, is used by many of these widely separated tribes to denote ski, and the argument is that the distance which separates these peoples precludes the possibility of direct transmission of the word by simple borrowing. From this reasoning Nansen believes that the region mentioned is the probable home of the ski, its origin being of remote antiquity when the five main branches of the Mongolian race lived in mutual proximity.

All the names of ski, with but few exceptions, can be gathered into a small number of typical groups or classes; single members of these groups are found at intervals throughout the whole of northern Eurasia; the three most important of these classes are:

1. Sok, suk, with their analogues tokh, hok, kok. From the Japan and Okhotsk Seas among the Goldes, the Manikow, Kondogiri-Tunguses, these are to be traced to the Baltic Sea among the Finns.

2. Sana, tana, hana. Among the Burjats around Lake

Baikal, and the Samoiedes by the River Yenisei in northern Siberia.

3. Solta, sylta, sildae, sille. Elements which are found in compound forms among the Goldes in eastern Asia, and the Tunguses; analagous forms are used by the Samoiedes in northwestern Asia.

In the type of more modern origin are included ski of Norway, skida of Sweden, lysha and golysha of Russia, lyzwa of Poland and lushes of the Litts, all of Aryan origin.

In Finland, in northern Russia, 'and in the whole of northern Asia east to the Behring Sea ski are much used to-day. By Norsemen they have been introduced in modern times into Greenland and Iceland, and in later days Scandinavians have carried them into our own Northern States of Minnesota and Wisconsin. No other trace of the true ski has been found on the Western Continent, the narrow oblong web shoe of Alaska being the only type at all approaching it. In Norway various form of ski are used to-day: Long and narrow, short and broad; with one groove or two or more, or even with none at all; some covered with skin and others without. Each of these various forms have advantages over others depending on the condition of the snow and the nature of the ground.

On plains and open plateaus where rapid progress is desired, the long, narrow form is best.

In rough, rocky ground, heavily wooded, the short, broad form can be better managed. The former is the type used exclusively in Yellowstone Park. This ski is from 9 to 12 feet long, 4 inches wide, with its sides, parallel from the curved-up toe, about an inch in thickness in the center, thinning toward either end to about one-fourth of an inch; the nose or toe, which tapers to a point, is bent up to a right-angled curve when new, but after use the curve lessens owing to the natural tendency of the wood fibers to resume the straight line; the rear end is not turned up; along the whole length on top is a ridge which contributes strength and rigidity, and along the under side is a central groove which acts as a keel.

Ash is the wood usually employed in making the ski, though pine, fir, maple, birch and hickory are also used. The toggle, or arrangement to hold the foot, is attached at the center so that the ski nearly balances, the heel, however, being slightly heavier.

A tin plate is tacked on the top of the ski at this point, on which the foot rests; straps are tacked on at the sides and lace over the toe; a ring is fastened to each strap near the ski, and from these rings straps secured by a buckle, pass back around

the heel; another strap passes from the heel strap up over the ankle. This toggle firmly secures the apparatus to the foot by the toe, allowing the heel to be raised freely in the ski movements.

The park soldier on snowshoes always carries a pole or staff about six feet in length, which he uses as a balancing stick and also as an aid to progress; about six inches from the end there is a wooden disc or button four to six inches in diameter, which gives a bearing or resisting surface against the snow. In coasting, when it seems necessary to retard the speed, one rides this pole like a child playing "stick-horse." The staff used in Norway is much shorter; it is discarded altogether by the enthusiastic skilöbner, who acquires great skill and often makes phenomenal jumps.

The ski used in the park are never shod with fur or hide, though I am told that west of the park in the Henry Lake region, strips of elk skin are sometimes set into the bottom; it is said that this acts well and as the hair points backwards it takes hold of the snow and forms a resisting surface in climbing hills. Sometimes, too, two short staves are used in this region by which the skier aids progress by pushing backwards with his hands.

So far as I know, the use of the ski in the park has always been confined to the hard work of patrol and other duty. Its use in the athletic sense for speed trials, and jumping matches is unknown.

It may be of interest to many to know that the record jump, up to 1893, was 102 feet, and the record run, 8 miles in 54 minutes 2 seconds, both held by Mikkel Hemmestvedt, a native of Thelmarken and champion of Norway and America. I believe this record has been broken, but have no later data. Nansen mentions a run of 31 miles 122 yards over hilly and variable country, in 1888, by a Thelmarken peasant, in 4 hours and 26 seconds; another, a contest won by a Lapp, of $136\frac{3}{4}$ miles in 21 hours, 22 minutes. In the park work the itinerary is usually planned to cover about 20 miles a day.

In ski travel, the progress made and the fatigue which ensues, depend very much on the condition of the snow. Snow that has sunk and packed from a mild thaw and then frozen, renders the conditions favorable; wet snow in mild temperatures sticks to the skis, forming thick masses which, unless cleared off from time to time, makes progress impossible; newly fallen snow too, has a tendency to stick, even though it falls with the temperature low. If it lies closely, not only does the snow adhere, but the ski will sink too deep; a mealy, fine, snow which has been raised,

driven and packed or drifted by the wind is unfavorable to progress.

In unfavorable conditions men traveling take turn about in going first, "breaking trail," others follow in the trail thus made in single file.

If a freeze follow a rapid thaw, the surface may become so icy as to be really dangerous, as that the ski can take no proper hold; but if on this surface one can get an inch or so of new snow, then the conditions are pronounced fine.

It is customary in the park, to treat the under surface of the skis with beeswax, so as to facilitate gliding and prevent snow from adhering.

In using skis the stride is peculiar. One foot is drawn forward and thrust ahead so as to acquire a sliding motion; while thus sliding, the other foot is brought up and repeats the movement, then the first foot again, and so on. The skis are not lifted from the snow, but are pushed forward by peculiar movements, or thrusts, of the thighs throwing the weight of the body forwards to aid impetus; it is hardly necessary to state that the skis are kept parallel. On ground comparatively flat, good speed can be attained; in going down hill one literally flies, but going uphill is altogether a different proposition. If not too steep, one may go directly up lifting the skis slightly so that the sticking snow may overcome, as much as may be, the tendency to slip backwards; if steep, the summit is reached by zigzaging; another method is by side-stepping, or "corduroying." Nansen describes a feather-stitch-step which I have never seen practiced; the skis are turned out at as wide an angle as seems necessary, and advanced alternately one in front of the other; if the skis are too long, it can not be done as the heel would over-lap the toe; the tracks left in the snow resemble the "feather-stitch" of the seamstress, hence the name.

In coasting, good skiers use the pole only for balancing, but those less skilful, ride the pole as a break to retard speed; the speed attained is sometimes terrific and many bad falls occur; should the ski strike an icy place the suddenly increased speed may cause the rider to lose his balance and a disastrous fall result; should, again, the ski strike a portion of the declivity where the snow was in a less favorable condition, suddenly retarding the speed, the momentum of the rider may carry him forward, resulting in a fall, and a delay of many minutes in extricating himself from the tangle. It is not uncommon in these falls for the skier to go completely out of sight in the snow and many times the skis have to be removed before the victim can properly adjust himself so as to proceed on his way.

To those unaccustomed to skiing it is most arduous labor and complete exhaustion is not infrequent with beginners. Experienced men move with ease and facility, and with only ordinary fatigue. As before mentioned, twenty-mile trips are those usually taken as a maximum, but skilful men do not hesitate to undertake one of forty miles a day if it is demanded by circumstances. A beginner in facing about on skis, makes rather slow progress, as he must of necessity take short steps throwing the toe of first one ski and then the other in the desired circle; if thrown too far, the ends overlap and trouble follows. The expert, however, does thus: he lifts one foot forward high from the ground so the heel can be brought forward and with a swing and a turn of the foot, causes the toe of this ski to point backward, and brings the foot to the ground, the skis parallel, but the toes pointing in opposite directions; the other foot is then lifted and the ski simply carried around the first leg until the toes of each point in the same direction, and the "about face" is completed. It sounds simple, but many a fall has to be taken before one masters the "easy" movements.

During the winter months the main garrison is at Fort Yellowstone; at several points in the park—eight as shown by the superintendent's latest report—are maintained "winter stations" garrisoned usually by one non-commissioned officer and three men. These detachments occupy comfortable log buildings chinked with plaster or mud; they are furnished the ordinary equipment of the soldier, the ration, and such additions to it as the state of the troop fund will permit. All supplies for eight months are put in early in the autumn, while wagon transportation is available; as winter approaches, the horses of the men are sent in to the post and the men take to their skis for patrol work. Each station has assigned to it a certain district which the men must keep patrolled, watching carefully for any evidence of poaching, and in general noting anything of interest as to the game seen, its condition, movements, etc.

The non-commissioned officer in charge is required to make monthly reports of the work done, the trips made and all matters of interest.

At intervals throughout the park, little huts, designated "snowshoe cabins," have been constructed at about a day's trip apart. These cabins are stocked in the fall with a small amount of food, some bedding, fuel, cooking utensils, an axe, a shovel, etc. These are designed to increase the efficient radius of the permanent stations, for without them no trip could be made which would consume more than one day on skis, or at most more than two days, and that in mild weather, for while traveling

on skis, it is impracticable to carry the supplies and bedding necessary in cold weather. These huts enable the same force to patrol and protect a much larger area than would be possible without them. Each has a rude fire-place and by keeping fire all night, the chilled soldier may, after a hard day's work on his skis, pass in comparative comfort a night so intensely cold that it would be unendurable in the open.

The greater part of the clothing regularly issued the soldier is unsuited for skiing. On proper representation of this unsuitability by the Surgeon at Fort Yellowstone, certain changes were made so that the men could procure, on proper requisition, suitable clothing. Experience has shown that loose-fitting outer garments are best; the so-called "Mackinaw" or blanket coats are popular; the Army blouse is too close fitting and interferes with free movement. On the feet it has been found best to wear soft woolen socks next to the skin, over these Arctic or German socks, and over these a lumberman's shoe, a low-cut gum shoe with heels. The trousers issued by the Quartermaster's Department are usually worn, but the underwear is of inferior quality, mostly cotton, and unsuitable; good, warm, soft woolen garments have been substituted. The blue flannel outer shirt meets the needs satisfactorily. A Scotch cap with ear pieces is the favorite headwear, though many men wear the regulation fur cap; fur, however, is unsuitable and unsatisfactory for everything except gloves, as the violent exercise of skiing causes profuse perspiration and fur garments do not permit the skin vapors to evaporate and escape.

None but good, reliable men are selected for detail on winter station. It is essential that they should be thoroughly trustworthy, because of the peculiarity of the duty and the isolation. As the stations are cut off from communication with the outside world, they are, in a way, most dreary. As it makes the solitude less irksome if congenial men are together, to some extent, it has been the custom to select a suitable non-commissioned officer, who may express a desire for the detail, and to permit him to select his detachment from such approved men as may volunteer for the service. Two of these stations are on a telephone line, which connects with Fort Yellowstone, the others communicate in the winter by the ski alone; one of these is ninety miles from the post.

The winters are bitterly cold, and storms are frequent; frostbites are not uncommon, and in recent years two deaths have occurred because of exposure while on skis. In both instances a storm arose while the men were out. In the first the man was traveling from one station to another to get the mail; after the

storm subsided, a search was made, but he could not be found, and not until two years later were his remains discovered some distance from what should have been his route. It is supposed that he missed his way in the storm and thus lost his life. The other death was due to disobedience of orders.

Owing to the hardships of skiing and the liability of the skier to accidents, orders have existed since the death of the first man that no man, under any circumstances, shall travel alone. Two men were making the trip from the Lake station to the Thumb station; the snow was bad and the skiing difficult. One man found himself giving out and insisted on returning and requested his comrade to accompany him. Returning was the shorter distance to shelter, and the trail was broken by their coming; the trail to the Thumb was unbroken, it was considerably farther, but the man who was not fatigued refused to accompany the other back and insisted on pushing on. They separated and on the man's return to the Lake station, he reported what had occurred and a search party set out the following morning. The night had been severe and only a mile or two beyond the point where the men had parted, was found, apparently asleep, but frozen dead, the man who had pushed on.

The streams in many portions of the park are fed by hot water from geysers, boiling pools, or hot springs. On these ice never forms, they are open throughout the winter, be it ever so cold. Often times in making ski trips it becomes necessary for the party to cross some such stream. In the absence of bridges, artificial or natural, there is nothing to do but ford. So off must come skis, shoes and socks, and with his equipment borne on the shoulders, the hardy soldier slips from the bank of ice and snow into the water, wades across, and makes his toilet anew in the snow of the farther side.

The gaily colored posters gotten up to attract recruits to our recruiting offices, showing in beautiful colors the dress uniforms of our Army, are familiar to most of us. By bearing this recruiting advertisement in mind the remark of a patriot, who had just completed such a fording with one of his officers, can be appreciated: "Lieutenant, this wasn't in the picture!"

Men traveling on skis must travel light; each man carries a pouch or knapsack across his shoulders in which are his rations and other absolutely necessary articles. At his belt he usually carries a small hatchet and a revolver; a heavier gun is seldom carried. Poachers are usually men of desperate character, who do not hesitate to use weapons to resist arrest; fortunately no harm has come to our men, though several notable arrests have been made.

In addition to the soldiers, a number of scouts are employed for the purpose of protection and patrol. They are required to make long circuits of the park and the adjacent territory, and to render reports to the superintendent of the work done and the conditions as they may observe them.

The men on detached duty are seldom sick; for that matter neither are the men who remain in garrison, for the records for several years compiled in the office of the Surgeon-General of the Army, show the health of Fort Yellowstone to be better than that of any other post in the United States.

The stations are supplied with simple remedies and dressings, and the men are instructed how to use them. Should a man become disabled in winter, which has but seldom happened, toboggans or sledges have been extemporized by lashing together two or more skis and on this he has been dragged to the post by his comrades. These sledges are also used in carrying supplies from station to station when occasion demands; men drawing them travel tandem, pulling on a long rope so that one trail only is necessary.

While the use of skis in Yellowstone National Park is, perhaps, not military if speaking strictly in the military sense, their use by troops is the only means by which the duties required there can be accomplished.

The ski in Yellowstone Park, the snowshoe and sledge in Alaska, the casco, the caraboa and the carromata in the Philippines. Imagine the surprise of the Father of his country, could he be told to-day that these articles are indispensable to United States troops, and for troops serving in the localities named!

XXXI. PROPHYLAXIS AS APPLIED TO MILITARY MEDICINE.

BY

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Although the study of prophylaxis is of great importance in other branches of medicine, it is of even greater consequence in military medicine.

To keep men well in campaign without the environment for the practice of the very best modern medicine and surgery, is so essential for the success of an army, that too much stress cannot be laid on the importance of preventing disease. The fact should be impressed on the military surgeon from the time he enters the service that he must bend his energies to preserve the health of his men. The health of an army is paramount to everything. A body of healthy men lacking in tactics, would be more efficient than the finest drilled troops weakened in numbers, and exhausted by disease. Of course discipline, drill, etc., tend to improve the general health of the command, but we must not lose sight of the fact that sanitation is a *sine qua non* in military life.

Military prophylaxis embraces in the broad sense, 1st, examination of recruits, in order to obtain individuals not susceptible and predisposed to disease; 2d, care and health of troops, the latter being subdivided into everything pertaining to health.

In our State, the examination of recruits is mandatory, and it is to be hoped that this will obtain in every state, so that our soldiers in the National Guard will be in sound health when enlisted.

The examination of recruits should not be too severe in time of peace. The surgeon should be careful not to reject a man free from organic diseases and deformity, but simply lacking in development, for this defect is quickly remedied by military drill and gymnastics.

We must not forget that the militia should be a training school for our young men, and that many who have not a soldierly appearance, due to imperfect development, may finish the enlistment with all the physical qualifications.

In organizations where physical examination of recruits is not required, the surgeon should be ever vigilant to have men dis-

charged who are below standard. From my experience at camp, before an examination of recruits was required, I should say that men with organic heart disease are more apt to enter the service than any other class of sick men, inasmuch as this disease in some forms is not indicated by marked symptoms in its early stages. I have discovered cases of this disease in apparently healthy enlisted men, who presented themselves for examination for some minor ailment at camp.

Men with tendency to asthma, bronchitis, consumption and hernia, sometimes enlist.

The Surgeon, by making examination at sick call at camp, can detect these cases, and they can be weeded out. These men can be discharged for disability. No one should be retained in service if sick, no matter how valuable he may be. I remember one case where the company commander did not want a man discharged, though he had organic heart trouble, because he was a good marksman.

It is rare that we find a man enlisting, who knows that he is a victim of heart disease, asthma, bronchitis, consumption, hernia, rheumatism, etc. I should be inclined to examine him mentally, for what pleasure can such a man get from military service?

In case of active service the men who are subject to these diseases, will, in many cases, apply for discharge for disability. Those who go to the front, with but few exceptions, are soon disabled and become a burden. The perfectly sound man has enough to do under the rigors of war to keep himself in condition.

Perhaps I can best represent to you the physical requirements by picturing the ordinary recruit of the militia, at least such as I have seen in the regiment to which I was attached. A young man between 18 and 23 years, 5 feet 6 inches to 6 feet in height; weight 135 to 160 pounds; measurement of chest when in repose 32 to 33 inches, 36 when expanded; abdomen small, about 28 or 29 inches. I have never found the abdomen larger than the chest, in any of these young applicants. Heart sounds good and strong; pulse 70 to 80 per minute. Clear breathing throughout the chest. No rupture or tendency to such; no enlarged glands in the neck, or elsewhere. In many cases a tendency to flat-foot, owing to hard work before the body was properly developed. This does not, however, materially impair the efficiency of the soldier, as this young man enlisted, disciplined, and properly cared for, will make a good soldier, as far as his physical qualifications are concerned.

Of course, these remarks on recruits only apply to volunteer

militia. The regular service has a fine system for the physical examination of its soldiers.

Starting with a sound body of men, as near perfection in health as can be attained by careful examination, the Surgeon should be ever alert to recommend men for discharge who show any weakness which unfits them for service. Too little attention is paid to sanitation by the line officers, and the policy in the future must be to instruct all officers and their men in elementary hygiene and kindred subjects.

Emergency lectures following the course adopted by the Massachusetts Emergency and Hygiene Association, have been given with more or less regularity to the different organizations of the Massachusetts Volunteer Militia during the past seven or eight years. This association has furnished skeleton charts, etc., in fact, everything required for a course of instruction in first-aid to the sick and injured; it has also furnished diplomas to soldiers who have passed satisfactory examinations, and have been recommended by their medical officers.

To this course I would add camp hygiene, the prevention of contagious diseases, etc., embracing policing of camp, personal cleanliness, the importance of reporting venereal disease, to prevent its spread by drinking vessels and other means; care of water supply to prevent pollution; bathing; clothing; use and abuse of alcohol, tobacco, and like subjects.

No rules and regulations to prevent disease can be carried out without the intelligent co-operation of the officers and enlisted men. An officer high in command in the U. S. V. told me that he saw a soldier lying on the ground, and drinking from a stream that had been contaminated near its source by washing, bathing, etc. There was no need of this individual's endangering his health by drinking from the polluted stream, as there was an abundant supply of pure water in each regiment. Such reckless individuals form a small part of the volunteer force; the great majority are earnest, patriotic men who are anxious and willing to learn and practise everything which conduces to their physical welfare. For years I have believed in the importance of individual instruction to officers and men. My method has been to instruct each company of my regiment in the subjects mentioned above. I have always found the enlisted man eager to listen to instruction and advice on matters pertaining to health. Under care of troops, in my course of instruction, I speak first of the individual, for, after all, on his specific care depends the general health and efficiency of the body of troops, and I mention in some detail a few matters pertaining particularly to the health of the individual soldier, such as clothing, diet, etc.; also a few minor

troubles which cause the soldier no little inconvenience and suffering.

The responsibility for the health of troops really rests with the medical officer. Medical officers have the entire sanitary care of commands to which they belong. The regimental commander is responsible, as far as his orders affect his subordinates, who are accountable for the management of their respective departments.

"Under direction of commander, the medical officer supervises the hygiene of his post, buildings, drainage, sewerage, amount and quality of water supply, etc."

It is safe to say that the commander will always co-operate with his medical officer in everything pertaining to the health of his command. The medical director should immediately report to the commander, anything prejudicial to the health of the command. Starting in with healthy troops, how shall we keep them so? More is to be feared from disease than wounds.

Keep the soldier occupied mentally and physically. In time of peace equip armories with gymnasia, and libraries; pay much attention to setting-up drill, and calisthenics. Riding schools furnished by the State are desirable. At camp I am in favor of barracks, and under the present system I think fewer men should be quartered in tents. Better facilities should be given for bathing, attending to the wants of nature, etc. I would recommend in case of inclement weather, to keep troops in armory, until appearances indicated fair weather.

In my own State, more than once, a brigade has gone to camp in rainy weather, and remained there during five days of almost continuous rain. By quartering in armories, the State could receive some work from the soldier; they could attend to ordinary military duties and drill. You cannot toughen a man by exposure for a few days. Use him well and he will be able to do the work required. A well cared for, well fed man makes a better soldier than an ill fed, ill kept person who is exposed to the vicissitudes of climate, etc. The former readily adapts himself to hardship, if necessary. From a hygienic point of view, we should also consider the following in connection with the health of troops: Transportation of troops; site of camp ground; water supply; care of quarters; regulation of duties of soldiers; policing; the care and the prevention of contagious diseases, etc.

In the transportation of troops it should not be forgotten to have the supply of water at the end of each car; also to have the cars properly heated and ventilated. The supplies for medical officers and the means for transporting wounded men, must receive careful supervision. If regular ambulances cannot be procured, the Surgeon will give the commanding officer prompt

notice. In such a case the Quartermaster should be ordered to provide a light wagon, or a wagon with springs and cover, if possible. With our efficient Ambulance Corps, there will scarcely be need to resort to this method.

In selecting site of camp ground, one must consider wood and water supply, healthful location, and roads by which supplies are to reach camp. There must be good natural drainage. Avoid marshy and malarious districts. Water should be tested. After site is selected, sentinels should be placed on guard over the water supply to prevent waste and pollution. In quality, the principal points are to ensure that the water is clear or is easily cleared of sediment by filtration; that it is well aerated, pleasant to taste and without odor; that it contains no injurious animal constituents, and cannot be contaminated by excreta, refuse water, etc.; that it contains no injurious amount of vegetable matter, and that its mineral constituents are of moderate amount and consisting of such mineral matter as not to be injurious. The really practical point in choosing water is to ascertain its freedom from contamination by excreta, or refuse matter from dwellings.

I expect in the near future, that our volunteer soldiers at annual encampment will be trained to care for drinking water, as in actual service. They should be taught to prepare it for use by boiling or filtering (no matter how pure), to impress on their minds the importance of such procedure.

If streams furnish water for an encampment, the upper portion is reserved for drinking and cooking; the middle portion for watering animals, and the lower, for bathing.

Ditches are not allowed to be dug around the camp grounds, but would be desirable in campaign. Bedding and bed clothing should be aired thoroughly, every day. Tents ventilated by looping.

Proper places for bathing and washing should be established. No one should be allowed to wash within 100 feet of the well. Sinks should be dug. In selecting sites, conformation of grounds, prevailing winds, etc., must be considered. The earth from excavation will remain on side of trench to be thrown back, a portion at a time, every morning and evening.

REGULATION OF DUTIES OF SOLDIERS.

There is no excuse for drilling men regardless of extremes in weather. It is a good way to keep good men from entering or remaining in the service. In this connection the following is quoted from Report of Surgeon-General H. L. Burrell, of Massachusetts, 1894:

"While it is the duty of every medical officer to call the

attention of his commanding officer to any danger that may take place from exposure of troops to the sun, yet the commanding officers should appreciate that the falling in line of a number of men, calls in question their good judgment in handling troops. If it is necessary to hold reviews and ceremonies, they should be held at a suitable hour in the day, i. e., near sunrise or sunset, rather than in the middle of an afternoon of a hot summer day. While, as a rule, the injuries received by men falling in line from heat or exhaustion, are purely temporary, yet at times serious and permanent injuries result."

Kitchens must be well ventilated and have good drainage. They must be inspected every day by commanding officer, officer of the day, and medical officer. The employes in this department need most vigilant supervision. At camp, cooks as a rule, have no special interest in military matters, and must be carefully watched.

Contagious cases should be isolated in a remote portion of field. The same precaution used in civil practice applies to the prevention and spread of measles, scarlet fever, mumps, and typhoid. In the late war, typhoid was the disease which caused greatest havoc, and I shall devote some space to describe methods to prevent this affection. The same general principles for prophylaxis in typhoid apply to other contagious and infectious diseases.

So much depends on the prompt detection of typhoid in its incipient stage that I would recommend the following as a simple and effective method to detect the disease in its early stage in regiment. The same method could be applied to Hospital Corps at division hospital. A nurse, carrying with him the germs of disease, could easily spread it among patients.

Take for example a regiment of 1,300 officers and men just mustered in to U. S. service. Supplied with one dozen of clinical thermometers and three assistants to act as clerks, the three medical officers could take the temperature of every soldier. The temperature of every man in the command could be ascertained in 10 to 12 hours. All having a temperature over 101° should be classed as suspects, and isolated; all between normal and 101° should be placed under strict observation. Had this method been adopted at state camps, many of the typhoids that disseminated the disease in the volunteer Army, could have been isolated and the spread of typhoid be prevented to a considerable extent. The same method should be practiced once a week with Hospital Corps and the nurses at hospital.

A bacteriological laboratory well equipped in every division hospital, would add greatly to its efficiency. For detection of typhoid the Widal test could be promptly applied to every sus-

pect. Personal cleanliness, cleanliness of surroundings, and care for sick, are important elements in prevention of disease.

As suggested in early part of this paper, the importance of personal cleanliness can be taught officers and enlisted men.

Policing of hospital grounds should be done by Hospital Corps. Late in the summer of 1898, so many patients needed the care of Hospital Corps nurses, that it was necessary to depend on a detail of men from regiments. Policing is so essential to the general welfare of hospital and camp, that the Surgeon in charge of division hospital should give it his personal attention. To illustrate the importance of this, I will relate an incident in connection with Second Division Hospital at Camp Meade. When I commenced my duties as Chief Surgeon of Second Division, I found the hospital grounds poorly policed. I called the attention of Surgeon in charge to the matter, and he told me that a detail from ——— Regiment was on duty for that purpose. I directed him to send for detail, and to his surprise he found only one man on duty. I promptly sent an official communication to commander of division, calling his attention to the neglect of duty. The offenders were punished, and there was no more trouble with the policing of those grounds.

Care of Sinks.—At First Division Hospital, Camp Alger, we had five sinks besides those used by Hospital Corps—one for the officers of the hospital, one for nurses, one for patients, one for the venereal patients, and one for the stools of typhoids. These sinks were dug in the regulation manner, and covered with fresh earth three times a day. A large sign on the venereal and typhoid sinks designated them. Besides the fresh earth, and the disinfectants used in the bed pans of typhoid stools, fresh lime was thrown in the sink, where they were deposited, several times daily. I do not think this system could be improved upon. Throwing the typhoid stools in barrels, and then emptying them, necessitates more or less slopping. Besides the barrel must be cleaned, and this endangers the surroundings more or less by spreading the bacilli, particularly where the work is entrusted to careless, indifferent, or ignorant persons. Properly disinfected in the bed-pan, promptly buried in dirt and lime, is the best and proper disposal of typhoid excreta.

For the ordinary sinks no disinfectant is needed. Lime is a good deodorizer, but I think its free use in sinks may interfere with the absorptive powers of the natural soil. This interference with absorption of fæces by the soil, is no disadvantage unless the same ground is used for sinks. If there is sufficient room, the sinks should be filled in, and new ones dug every third day. To my mind the regulation sink of the U. S. Army properly cared for, cannot be improved upon.

The following are essentially the rules of Dr. Fitz of Harvard, to be observed by attendants in care of typhoid fever. They have given good satisfaction in my service at the Carney Hospital, and with slight modifications, might be adopted for field hospital:

I. Mattresses and pillows (when liable to become soiled) are to be protected by close fitting rubber covers.

II. Bed and body linen is to be changed daily. Bed spreads, blankets, rubber sheets and rubber covers, are to be changed at once when soiled. Avoid shaking any of the articles.

III. All changed linen, bath towels, rubber sheets and covers, are to be immediately wrapped in a sheet soaked in carbolic acid (1-40). Remove them to the rinse-house as soon as possible. and soak six hours in carbolic acid (1-40). Then boil the linen for a half hour and wash with soft soap. The rubber sheets and covers are to be rinsed in cold water, dried and aired for eight hours. The bed spreads and blankets are to be aired eight hours daily.

IV. Feeding utensils, immediately after using, are to be thoroughly cleansed in boiling water.

V. Dejections are to be received into a bed-pan, containing half a pint of carbolic acid (1-20). The nates are to be cleansed with paper, and afterwards with a compress cloth, wet with carbolic acid (1-40).

VI. Add two quarts of carbolic acid (1-20) in divided portions, to contents of bed-pan; mix thoroughly by shaking and throw the liquid into the hopper. The bed-pan and hopper are to be cleansed with carbolic acid (1-20) and wiped dry. The cloth used for above purpose is to be, at once, burned.

VII. After the discharge of patient from the hospital, the mattresses are to be aired every day for a week. The bedstead is to be painted.

VIII. In case of death, the body is to be covered with a sheet, wet with carbolic acid (1-40).

IX. Attendants should thoroughly wash hands in solution of corrosive sublimate (1-1000), after coming in contact with patient, bed-pans, etc.

A well equipped bacteriological laboratory in every brigade or division will aid us in the early detection of disease, and thereby prevent its spread. A garbage plant can be utilized for the destruction of sputa from tuberculosis, typhoid and other contagious diseases; also for the refuse which accumulates in the vicinity of hospital or camp. Let us hope that in the immediate future, military medicine will avail itself of every improvement in medical science to prevent disease.

XXXII. DO THE LAWS OF PHYSICS APPLY TO THE HUMAN BODY?

BY

MAJOR W. O. OWEN,

SURGEON U. S. ARMY.

One of the laws of physics is that it requires the same amount of energy to raise the temperature of an inorganic, or dead organic body, a certain number of degrees, as it does to reduce their temperature the same number of degrees.

Does not each human body have a point in external temperature, its normal temperature plane, at which the body is not called upon for an expenditure of energy for temperature regulation, at which the thermo-accelerator and thermo-inhibitory centers are balanced with no call upon either?

Does not each degree of external temperature above or below this plane result in an expenditure of an equal amount of force from the energies of the body for the purpose of regulating to the normal temperature?

It appears that the above two questions are fair deductions from the foregoing well known physical law; and I can see no good reason why they shall not be taken in conjunction with the well known fact that an expenditure of energy by the body in labor requires an increased supply of food if the organism is to retain the same amount of energy with which it commenced the labor—may not be taken as a basis upon which to calculate the ration of our troops in the tropics?

In the tropics our soldier is subjected, without any rest, night or day, to a temperature far above the normal plane, and in addition to this never ceasing call upon his energies for temperature regulation (in cold climates he can build a fire, put on heavy clothing, and live in heated houses), he is called upon to supply force for marching and other labor.

It is a mistake to undertake to cut down his food allowance, reasoning upon the fact that the food allowance of the laborers of the tropics is different in character. The laborer of the tropics does not take rice, bananas, etc., from choice, but from the fact that the cost of nitrogenous diet in the tropics is greater than he can, with his lazy habits, afford to pay. The same reasoning may be used by taking the diet of the average French peasant from which to calculate the diet our soldiers had better use in latitude 49 degrees North.

To say that the unfortunate soldier should have his food allowance cut down because he suffers from disease, which disease we choose to say is due to his imprudent diet, and over-loading his stomach and bowel with food which he does not need, and his blood and other parts with material which has to be excreted, as it cannot be used, is, I think, an error. All of us to-day feel that one and all of our diseases are due to the growth of foreign germinal matter within our bodies.

It is known that the tropics with their high temperatures and moist atmosphere permit to a greater degree the external existence and more rapid growth of these germinal matters. Our food stuffs are, one and all, good culture media for these growths. Yet we study and work with undying faith that tropical disease is due to our having introduced into the body wrong amounts of the dead organic matters upon which we feed and upon which in colder climates, we prosper and are filled with energy. And we are told that those of our race who go to these hot regions must change their food habit, and eat less of meat, etc., of our northern diet, and more of the rice, etc., of the diet of these hot regions.

The constant demand for temperature regulation upon the bodily energies of itself requires food. Yet we keep our soldier with much heavier clothing in the tropics than the native wears, forgetting the extra amount of force thus required. Our people go into these regions full of energy and do an amount of labor that is simply astonishing to the native, with the result that the demand from labor and temperature regulation exhausts and the appetite fails just as it does further north, and we do not at all realize the increased cost of this slightly heavier clothing.

The loss of bodily weight in the tropics is due to an expenditure of energy greater than that which is supplied. The loss is greater in damp, hot weather, than dry, hot weather, because the call for temperature regulation upon the bodily energies is greater, from the fact that in damp, hot weather the temperature, the saturation point, of the atmosphere, is near that of the body, with the result that the cooling resulting from vaporization of water from the skin and lungs is much impeded, whereas, if the air is dry, it is facilitated, and the work under the last is done largely by external causes instead of at the expense of the bodily energies. For this reason the body does not respond with the same energy in hot, damp weather as it does in cold, dry weather. Its energy has been used to regulate its own temperature.

The circulation of the fluids of the body is controlled by

two hearts; one, the central, the other the external; the one within the chest; the other is composed of the capillaries, and the involuntary muscles connected with them, of the entire body. For my purposes those of the skin alone are considered, hence the term skin heart. (Baruch.)

The skin heart, like all other involuntary muscles, contracts and dilates, rhythmically, in this way assisting the central heart in the propulsion of the fluids of the body.

Under the constant high temperature of the tropics the skin heart is dilated, becomes of greater capacity, and is stimulated to a more rapid, rhythmical contraction, so as to force the passage of a greater quantity of blood through the cooler skin, and thus hold the normal temperature. When it is remembered that at the time the energies of the body are converted so that 20 per cent. appear as force, 80 per cent. appear as heat, it does not require deep thought to see what a load is thrown upon the skin heart under the labor in the tropics, at a time when it is already carrying a load from the temperature alone.

This skin heart is one of the most extensive organs of the body, and under the conditions given above, it is called upon to expend an enormous amount of involuntary muscular effort in assisting the central heart to pass the blood through the cool skin, and in the tropics this expenditure goes on night and day with or without labor, and I am convinced that this skin heart beat of increased force and rapidity is why man cannot do the same amount of labor in the tropics which he does in a cooler climate, for in the colder climate he uses clothing and artificial heat to protect his skin heart from the action of the temperature of the air.

Temperature regulation of the body in the tropics is very largely a matter of the amount of blood passed through the skin, for the lung, as a factor in this, is unable to do its customary part, because of the amount of the vapor of water which tropical atmosphere, as a rule, carries.

A very erroneous statement is found in most works upon hygiene, which bases the calculation for less food upon the statement that owing to the increased temperature of the tropics man uses 7.5 per cent. less air than in the temperate zone. The air which man uses in his lungs is of the same temperature in the tropics as it is in the arctic regions, namely 98° F., and he therefore gets exactly the same amount with each respiration of the same depth in each locality; the CO_2 content of the tropics and temperate zone is practically the same, and the air of each will take and give from and to the lung the same amount of CO_2 and O as a mere matter of exchange, but owing to the

greater water content of the air of the tropics, the air of the tropics will not remove from the lung the same amount of water; hence the lung does not assist the skin heart to control the temperature to the same degree that it does in the temperate climate.

How often has it been determined by direct experiment that man excretes less CO_2 and N in the tropics than in the temperate zone? I know of no experiments upon the human body to determine these excretions under labor and without labor in the tropics.

It has been recently stated that the native of the tropics who feeds upon rice, fruit, etc., suffers greater liability to and more fatality from bubonic plague and cholera than his brother who has had, in addition, a larger amount of meat and other nitrogenous food.

I had charge of 300 convalescent patients and 50 Hospital Corps men in the tropics for several months, and I found that these men consumed all of the beef, eggs and chickens which I could get for them, and they wanted more. This hospital was on Corregidor Island, Manila Bay, P. I., and I think the record will bear me out that these men all did well, and that the Hospital Corps men were in as good mental and physical condition as any in these Islands. My personal experience was that, while I tried to live after the manner of the theory, that I needed less food and a carbohydrate diet, I was depressed, and that when I returned to my nominal full meat diet that my energies returned.

My native servants ate with evident relish and benefit to their bodies, all the meat that my personal mess could spare them.

My conclusion is that we should not decrease the soldier's food in the tropics, but rather increase it. What he needs is not less food, if his energies are to be kept up, but more food, and that food to be of far better quality.

His food is all right when it leaves the United States, but tropical conditions infect it with tropical germs with the very first indication of carelessness, and then the food is condemned as the cause of the disease, when the truth is that the cause is the carelessness of those handling the food.

I offer the above theory of the labor performed by the involuntary muscles of the skin heart as a rational explanation of the exhaustion so often seen when the human body is called upon for labor in the tropics; and why I advocate, that, if any change is to be in our soldier's diet for the tropics it be increased, particularly the fresh meat component, and that far greater care be taken in the preservation and modes of preparation of his food and drink.

I am firmly convinced that if this is done, that we will have less said about the disease resulting from an improper amount and quality of food, and less of reducing his ration.

When a boiler is fed with dirty coal, it soon ceases to steam, and the best plan to make it steam better is to purchase and use the very best coal that can be had, and to get an ample amount of it.

XXXIII. AN IMPROVED CLOSET FOR CAMP LATRINES.

BY

CAPTAIN GUY C. M. GODFREY,

ASSISTANT SURGEON, U. S. ARMY.

This is a dry-earth closet, although lime is preferable and even milk of lime may be used in the cans.

The accompanying cuts show this closet, the front of which in Fig. 1, is partly cut away so as to show the can in position. The latrine is of wood and of the appearance shown in Figs. 1 and 2. At each end of the seat-box is a small window covered with gauze wire netting, which is intended to afford ventilation and at the same time to prevent the entrance of flies. This ventilating window is 8 by 8 inches, and is protected from outside violence by two wooden cross-bars. Its entrance is connected with a tin or wooden elbow inside of the seat-box. This elbow is of the shape and dimensions shown in Fig. 4, and is painted black inside and out. Its internal opening faces from the cans as shown in Fig. 4, so that no direct rays of sunlight fall on the cans. This inner entrance is also covered with wire netting, as experience has demonstrated that the outside netting is liable to be broken. As an additional prevention against the entrance of light, two flanges of wood or tin, 8 by 3 inches, are placed in the elbow at such angles as will cut off any reflected rays of light. (See Fig. 4.) Two 3-inch ventilator pipes, see Fig. 1, enclosed partly in a wooden casing, provide for free ventilation of the seat-box. These pipes are made of tin or other suitable material, are covered at the top by gauze netting and are provided with a tin cap for protection from the rain. They can be made entirely of wood, which is cheaper.

Each hole in the seat-box is raquet-shaped, as shown in Fig. 3, with the broad end in front and the edges beveled for an inch on either side. It is cut through 1-inch board; is 10 inches wide at the top and 8 inches wide at the bottom of the bevel, and is 17 inches long. It is raquet-shaped, so as to prevent precipitate diarrheal discharges from soiling the seat. As shown in Fig. 3, the front end is cut away, leaving a cone-shaped space to prevent the seat from becoming soiled by urine. However, any form of hole may be used. An ordinary square lid will answer as well as that shown in the drawings.

When the accompanying illustrations were drawn I thought of having an iron peg to prevent the lid from falling backward

Fig. 1.

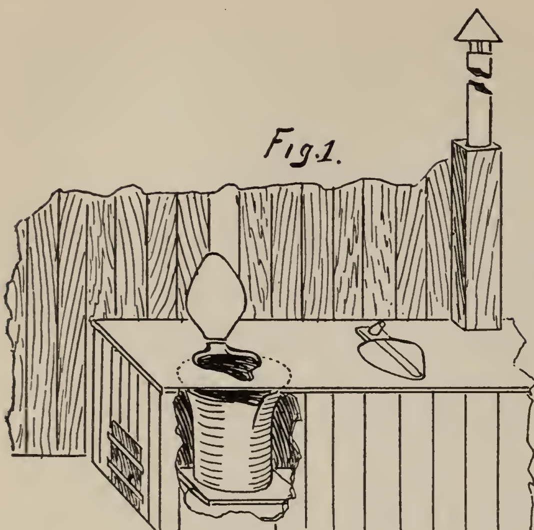


Fig. 2.

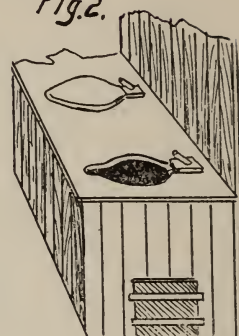
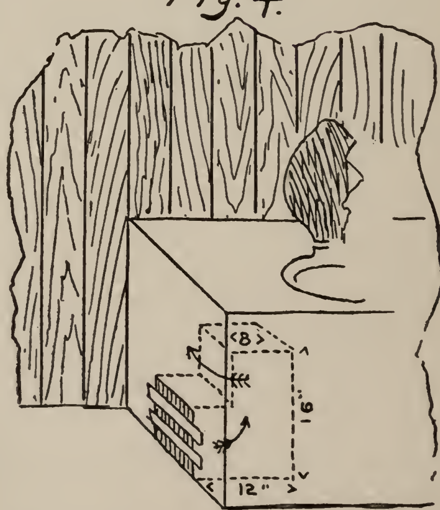


Fig. 3

Fig. 4.



beyond a right angle, but since that time I have used an ordinary bar of wood running behind and above the seats. This bar prevents the lids from being raised quite to the perpendicular, so that when the person rises from the seat, the lid immediately falls,

shutting out sunlight and flies. The bar also prevents persons from standing up on the seat and thus using it.

At the back of the seat-box, which is also the rear of the latrine, are hinged doors through which the metal cans or pots are shoved into place beneath the seats, where they are guided and held in position by wooden blocks or stays nailed to the floor of the seat-box. As stated before, dry earth, lime or milk of lime can be used to cover or receive the excreta. The cans should fit closely beneath the holes.

If an odorless excavator can be obtained, I would in this connection, suggest that a tank containing milk of lime, such as that described by the board of which Majors Reed, Vaughan and Shakespeare were members, be substituted for the cans, but that the seat system above described be retained.

One serious objection occurs to me in the apparatus described by the board, namely: that forcible diarrheal discharges will spatter against the rear side of the tank above the water line, and that there is nothing to prevent flies lighting thereon. As the contents of the tank are stirred only three times daily, several hours might elapse before the evil would be corrected, if at all. The only way to avoid such an occurrence is to have a fly-proof seat or a wider tank. A wider tank, however, would not overcome the objection mentioned by the board, of flies lighting on pieces of paper covered with excreta and floating on the surface of the fluid.

The objections to the above described system of pots and closets are:

1. The shape of the hole with regard to flies entering behind the occupant while the closet is in use. As the seat-box is totally dark inside, I doubt if flies will enter through the small space in rear of the occupant. The entire interior of the seat-box is painted with black tar paint, excepting the lower side of the lid and edge of the seat-hole, which is covered with ordinary black paint.

2. The possibility of the lower side of the lid, which rests against the occupant's back, becoming infected. This is not probable, but could easily be obviated by disinfecting that part of the lid when necessary.

3. The possibility of flies entering the pots before they are covered, while they are being taken out of the closet to be emptied. If they are covered with disinfectants as they should be, this objection is not material.

4. The liability of some individuals to place rocks or other obstacles beneath the lids to keep them always raised. A proper notice to prevent this should be placed in each closet, and persons found doing it should be punished.

XXXIV. A NEW METHOD OF WATERPROOFING MILITARY CLOTHING.

BY

CAPTAIN EDWARD L. MUNSON,

ASSISTANT SURGEON U. S. ARMY, WASHINGTON BARRACKS, D. C.

The proper proofing of the clothing worn by the soldier is a matter much to be desired from both the sanitary and the military standpoint. Much effort has been directed toward this end in the past, and various chemical substances have been employed in the accomplishment of this object. Of these the precipitation of a metal salt in the fabric by means of a soap solution, has been much employed; but perhaps the best method of such character consists in impregnating the garment with a solution of acetate of aluminum, from which the acetic acid evaporates, leaving the metal deposited in the cloth. All these methods, however, while undoubtedly rendering the cloth waterproof, have, for the military service, the fatal drawback of closing the interspaces of the fabric and thus preventing the free circulation of air. Clothing thus treated is close, hot and uncomfortable even at best. The body inevitably becomes soon overheated, because the evaporation of perspiration is prevented. Such clothing is obviously of value only for special occasions and, if used, must be regarded as an additional article in the soldier's wardrobe, and, in the field, an additional burden for him to carry. The ideal waterproof garment, therefore, is one which is originally part of the present authorized uniform, is altered by the process of waterproofing neither in color, weight, nor porosity, and is as available for use in sunshine as in rain. In this connection, the following letter written by the writer, is self explanatory:

"Washington Barracks, D. C., October 29, 1899.

To the Surgeon-General, U. S. Army, Washington, D. C.:

Sir:—I have the honor to invite attention to the use of wool fat, technically known as suint, or of its purified products, such as lanoline, as affording a practical means of waterproofing the apparel of the soldier.

My attention was long since drawn to the well known waterproof qualities possessed by the blankets woven by the Navajo Indians, from yarn spun by themselves from their native raw

wool. During the past winter it was noticed that of two such blankets possessed by me, both woven in the same manner by these Indians, one being made of the raw native-spun wool, while the other was woven from ordinary Germantown yarn, the former was waterproof, while the latter was not, and it at once became evident that the waterproof qualities of the former were dependent on the special character of the yarn itself rather than on any special method of weaving. Later investigation showed that in cleansing raw wool for trade purposes, great care was taken to remove all fat from the fleece, in order to render the action of dyes more satisfactory. Further experimentation showed that by restoring this wool fat in proper proportions to a fabric made from such purified wool, the waterproof properties well known to be possessed by the native Navajo blanket, are regained. Investigations have been continued on this line down to the present time, believing the idea to be original; but I have recently learned that the use of wool fat for the same purpose has occurred to another and that this idea has been advanced by Dr. Kolb, of Lyons, France, in a pamphlet dated 1899; the various results obtained by him having been confirmed by my own work on the subject. In view of the previous publication by him of this method of waterproofing, I therefore desire to disclaim any originality in the matter.

Theory.—The proposition presented is simple and merely includes the restoration to the fabric of an article which has been removed at the behest of a super-refined civilization; an article originally provided by Nature for the proper protection of the animal. Little reflection is necessary to show that, without such safeguard, the heavily fleeced sheep, when exposed to continued rain, would soon be unable to carry the weight of the water which would otherwise saturate its wool. The well known comparison with regard to water sprinkled on the back of the duck applies, in lesser degree, to the case of the sheep also.

Operation.—The method by which the operation of waterproofing is performed is extremely simple and consists in dissolving the purified wool fat, or lanoline, in proper proportion, in any of its known solvents, preferably benzine, on account of the cheapness of this liquid and the ease, safety and freedom from discomfort to the operator with which it may be manipulated. Experiments made by me show that the use of from twenty-five (25) to thirty (30) grams of lanoline in one thousand (1,000) cubic centimeters of benzine gives the most satisfactory results. The lanoline of commerce contains twenty-five (25) per cent. by weight of water mechanically incorporated with it. This water should be entirely removed before dissolving the lanoline

in the benzine, since otherwise the solution is opaque and milky and the results are not satisfactory. A clear solution is essential. Into this solution the fabric, to be waterproofed, is dipped, and allowed to remain until thoroughly saturated. After an immersion lasting about five minutes, the article is lifted out and the excess of the liquid allowed to drain off; this being usually sufficiently accomplished in one to five minutes, varying with the size of the article. Small articles, such as hats, are then hung up in the sun and air to allow rapid evaporation of the benzine; the wool fat being left behind in the fabric. Large articles, such as blankets or overcoats, should, after draining, be quickly spread out on some flat surface in the open air and sunlight. If such articles are hung up, the solution, before evaporation, tends to run down into the lower portion of the fabric, and an excessive amount of wool fat in this lower part results. Should this accident happen, however, it is easily remedied by returning the article to the solution, when the unevenly distributed wool fat is at once dissolved out into the solution and the impregnation made uniform.

It is evident that the process above described possesses no technical difficulties and can be carried out by anyone without previous training, without special apparatus and without the necessity of providing more than two well known, cheap, and readily obtainable ingredients. Clothing already issued can thus be waterproofed as well in the field as could new garments at the manufacturers or at the supply depots.

Amount of Ingredients Required.—Using due economy, the amount of solution required to waterproof the campaign hat, uniform, overcoat and blanket of each soldier may be approximately placed at about three quarts. With a three (3) per cent. solution of lanoline, the quantity of the latter substance required for the entire outfit of the individual soldier is about one hundred (100) grams, or a little more than three (3) ounces.

Cost of Waterproofing.—Benzine is to be obtained at retail at the rate of twenty-five (25) cents per gallon and could probably be purchased at wholesale at fifteen (15) to twenty (20) cents per gallon. Lanoline, which is a patented article, costs about one (1) dollar per pound. From these figures the outside cost per man may be estimated at about thirty (30) cents.

It should be remembered that the use of lanoline itself is not essential to success and that the much cheaper wool fat, deprived of its potash salts and aromatic constituents, can be used with fully as good results as with lanoline, and at less expense. At present, correspondence on the subject has shown that it is

difficult to obtain this partially purified wool fat; but this could readily be prepared, if desired in considerable quantity.

Properties.—Clothing, blankets and hats, when treated with a solution of wool fat, are rendered as waterproof as is Mackintosh cloth for all practical purposes. Water in bulk may be held in such waterproofed clothing a long time without leaking through, provided the constant water pressure is not greater than one inch. For rain the fabrics waterproofed in this manner are rendered practically impervious. Tests made by me on the campaign hat show that such material does not wet through even after a continuous exposure of three (3) hours to an ordinary shower bath of marked intensity. The outside becomes wet, but the moisture does not penetrate and may be almost wholly removed by a single shake. Where thoroughly soaked with water by prolonged immersion, the waterproofed cloth dries much more rapidly than the cloth not so treated. Instead of draining off only at the bottom of the fabric, the water tends to run to the surface at all points and may be seen to coalesce into drops and fall off at any part of the cloth where a slight fold or inequality affords a projecting point. The oily fibres of the wool themselves are not saturated, and the only water retained in the fabric is the water held in its interstices, the so-called "water of interposition."

It is well known that ordinary garments, when wet, become warm, depressing and uncomfortable to the wearer through the impaired passage of air and deficient cutaneous ventilation. This condition is largely due to the swelling of the moist wool fibres themselves, thus mechanically blocking up the interspaces in the weave. This condition practically does not occur in garments waterproofed as above; since the fibres themselves do not absorb moisture and do not enlarge under the influence of dampness. With clothing waterproofed with wool fat, ventilation is in no wise impaired when on the person; the fabric preventing the entrance of water as a fluid, but not retarding its exit in the form of aqueous vapor from perspiration.

As affecting the warmth of a garment for cold weather, no argument is necessary to show that the native Navajo blanket is in this respect without a superior. Wool fat does not mat the texture and, if anything, it increases the elasticity of the fibres.

Clothing waterproofed in this manner is not altered in color or appearance, and it is fair to presume that the life of the fabric is increased, as being less liable to deterioration by rotting.

The garment so waterproofed has a slightly unctuous feeling when dry, but no oily sensation is left on the fingers. When

wet waterproofed cloth is pinched, it has a slight gummy or sticky feeling. The wool fat, if properly purified, is inodorous; and this substance possesses the peculiar property of never becoming rancid. Tests, extending over some months, indicate that the waterproofing, once properly performed, is permanent; as, on reflection as to the nature of the material used and the intimate nature of its application, was to be anticipated. The use of boiling water or strongly alkaline soap will quickly destroy the waterproof qualities of a garment by driving out or by saponifying the fat; but neither of these agents is likely to be applied to the outer garments of the soldier. If, in rare instances, they are so applied, the remedy merely consists in again immersing the garments in the simple waterproofing solution above described.

Animal material appears, as it is to be expected, to more readily take up and more tenaciously retain wool fat than do fabrics of a vegetable nature; although the latter may, by its use, be greatly improved as to their water-shedding properties.

Advantages for Military Use.—The campaign hat, waterproofed by the above method, affords a perfect protection to the head of the soldier in the severest rain storms. It does not lose its stiffening when wet, does not increase in weight to any extent and preserves its original shape for a longer period than does the hat not so treated. By the use of such a waterproofed head-covering, the use of a hat, soft, flabby, leaky and heavy when wet, is done away with. The forage cap may also be waterproofed, as well as the campaign hat and thus the soldier in garrison is better protected against sudden showers and their results in the settling of the crown and other unsightly deformities.

If the blouse and trousers be waterproofed, the soldier is at all times protected against the military disadvantage of wetting and the danger of sickness arising therefrom. A blouse so waterproofed, will protect against any ordinary rain, and the trousers, in addition, keep the legs dry in wet grass or brush.

The overcoat and cape, when waterproofed, entirely take the place of the poncho or rubber blanket for the protection of the person on guard or in stormy weather. By the use of such garments, the necessity for supplying the poncho or rubber blanket, with their additional weight to be carried by the soldier, is avoided. A further gain in weight is found in the fact that the waterproofed clothing increases but little in weight, as compared with non-waterproof fabrics, when exposed to rain. With an ordinary rain the overcoat and campaign hat as now issued, take up about five or six pounds of water to add to the burden

of the soldier. This additional burden, coming as it does at a time when the condition of the ground is also unfavorable to marching, can and should be avoided.

As to the shoes, wool fat has long been known as an excellent agent for the suppling of leather. Shoes so treated are not only suppled, but waterproofed, and this is accomplished without the interference with the ventilation of the feet; as is the case with ordinary fats, which mechanically block up the pores of the leather with a fat which, later, becomes rancid, foul-smelling, and in hot weather, attracts flies.

The blanket, treated in this way, becomes waterproofed and the necessity for the use of the rubber blanket in camp is thus done away with. Anyone who has slept on the Indian natural wool blanket, appreciates what an admirable protection it affords against soil dampness. Like the other articles, if wet on the outside, it is far more readily dried than the non-impregnated blanket, a quality obviously of the greatest value in campaign.

In general, this method of waterproofing has the great advantage of rendering the ordinary clothing of the soldier suitable for all conditions of weather. No weight is added and no change for storm or sunshine is required.

Disadvantages.—If any defects exist in this method, they are not apparent to the writer. The somewhat sticky feeling of the impregnated material, when wet, is the only undesirable quality, and this is an objection aesthetic rather than practical.

This method of waterproofing is rational, simple and inexpensive. It is not patented and there is no obstacle to its free use by the Government. It is, therefore, urgently recommended that this method of waterproofing the clothing of the soldier be at once tried on a large scale, as being of peculiar value under the climatic conditions under which our troops are now contending.

A number of articles of the soldier's apparel which have been waterproofed by the method above described, are now in my possession and the validity of the above claims can at any time be established in two or three hours.

Very respectfully,
(Signed) Edward L. Munson,
Capt. Asst. Surg. U. S. A."

Shortly after forwarding the above letter, the writer demonstrated the practical worth of the method of waterproofing by lanoline to the Surgeon-General of the Army and the officers on duty in his office. The letter was then forwarded by the Surgeon-

General to the Quartermaster-General with an indorsement, inviting attention to the great utility of this process for military clothing, and stating that he had personally witnessed its efficiency on articles of ordinary apparel when subjected to the severest tests. The matter was then taken up by the Quartermaster's Department, and the process has, since November, 1899, been undergoing tests at the Schuylkill Arsenal, Philadelphia, Pa. These tests are not as yet completed and no official report on the subject has yet been made, but the writer is informed from the Quartermaster-General's office that the authorities are already sufficiently satisfied with regard to the value of the process, as regards its application to campaign hats, to order a large number of hats treated by this process to be issued to troops in the field. During the freezing weather of the past winter, it was found by the writer that garments treated with a 5 per cent. solution of lanoline, became slightly stiffened and felty to the touch. This was probably due to the freezing of the water—amounting to 25 per cent. of the total weight—which is mechanically incorporated with the lanoline after impregnation of the fabric. This objection is greatly reduced by using weaker solutions of lanoline, and is scarcely noticeable, in any temperature, with garments such as the trousers and blouse, which receive much of the animal heat from the person. Within the past few months, clothing waterproofed by the use of wool fat has been placed on the market by certain manufacturers, this method being presumably based on Kolb's process. It is understood that in these cases the garments are impregnated with wool fat, not by solutions, but by the use of hot steam rollers. The writer recommended in November, 1899, in a letter to the Quartermaster-General, that if this process was to be used on a large scale, it would probably be better to soak the cloth, in the original bolts, in a 10 per cent. solution of lanoline prior to making it into garments; this cloth was then to be passed through rollers and the excess of the solution removed, and evenness of impregnation thus assured. The writer believes that his process is superior to the commercial method above noted as, by the use of a solvent, the lanoline is carried into every fibre composing the fabric.

It would seem at present as if the use of wool fat affords by far the best method of waterproofing the clothing of the soldier.

XXXV. SHOULD MILITARY MEDICAL SCIENCE BE TAUGHT IN OUR MEDICAL COLLEGES?

BY

COLONEL EDMUND CONE BRUSH,

SURGEON GENERAL OF OHIO.

It has been said that the way to learn to shoot is to shoot. It might be said that the way to learn to be a military surgeon is to be a military surgeon. The man who is learning to shoot can be aided to a wonderful degree by having some previous theoretical knowledge of distance, explosives, trajectory and windage. The man who is to become a military surgeon, would be greatly benefited if he had some theoretical knowledge of military hygiene and military surgery.

Had our country a standing Army large enough for all purposes, it would be an easy matter to have the medical officers, attached thereto, take special training in the branches indicated in an institution provided for that purpose. As it is, we depend upon the volunteer soldier for any large Army and we must depend upon the volunteer surgeon to take care of the volunteer soldier, because the Medical Department of the Regular Army is too small to supply the demand for medical officers made by a call for volunteers. That the well being and efficiency of these volunteers depend on their physical condition and that this condition depends largely on the efficiency of the medical officers, who serve with them, is a proposition that can not be controverted.

The next question to be considered, is: How can volunteer soldiers be supplied with medical officers, who have had the kind of training that makes them efficient in preventing camp diseases, and in caring for the men in great emergencies? There is no trouble, at any time, in getting physicians who are skilled in private practice; but these same skilled physicians when entering the military service, need special attainments in order to make them efficient in their new work. The raw recruit in time learns much that he never dreamed of in the way of caring for himself. The raw volunteer surgeon will do the same in regard to caring for the men, but while he is learning, the men suffer from his lack of special knowledge.

It is of no use to prattle about the infrequency of wars and getting ready for war when war comes. The only thing to do is to be always ready for war. Suppose that every medical col-

lege instituted a chair of Military Hygiene and Surgery and gave its students a thorough course in those branches, what would be the result? In every class are men who have a fondness or predilection for some special branch of the healing art. Some like diseases of the eye; some like surgery; and so on. These same men, as they go on in life, are found drifting towards the branch or branches that suit their fancy best. If medical colleges gave instructions in military medicine, would there not be found men, among the graduates, who would drift towards that specialty—if you choose to so denominate it? What would be the result? These same men would endeavor to gratify their taste by going into the military service. They would seek the Army, the Navy, the Marine Hospital Service or Militia in order to gratify their desire for a military medical career. Suppose that all could not enter these branches, would not the others be ready and waiting for any unusual emergency that called for a volunteer Army? Would not their early training be of inestimable value to them and to the troops with whom they serve? This theoretical knowledge would soon be expanded by practical experience, and to the good of the service. Furthermore, every man who took such a course, even if he never entered military life, would be greatly benefited thereby for civil life. There could be nothing taught in the way of military hygiene that would not be of use to a man in civil life, at one time or another. There could be nothing taught in the way of military surgery that would not broaden and better qualify a man for every day practice. This whole subject would simply help the student in his preparation for his life work, wherever it might be.

I am aware that the subject under consideration is now being taught in a few medical schools. My object in bringing this matter before this body of distinguished medical gentlemen is to agitate the subject, so that military medical science, if you please to call it such, will become a part of the established curriculum of every advanced medical school.

There is no necessity for considering the past shortcomings of patriotic medical men, who, because of lack of training, were not efficient in the camp and on the march. You could not expect an oculist to step out of his field of work and take charge of an epidemic of typhoid fever, with the same skill and care that the physician, who had been treating that disease for years, could give it. You can not expect the physician, whose work has been in civil life, to drop that work and join troops in the camp, on the march, in the bivouac, and give those same troops the advice, the instructions, the care, that come from special

training and from special knowledge and from special experience.

Let me go a little farther. If the medical colleges are to take up this work, it must be done systematically and in unison. Definite ideas must be carried out and there must be some uniformity in the courses of instruction given in the various schools.

Not to do this would embarrass the undertaking and modify the results. How can this be accomplished, you ask? Suppose that the government should perfect its school, or schools, for the training of medical men of the branches of our armed forces. Suppose that these schools adopt and promulgate a thorough course based upon practical knowledge and proper text books. Suppose that the teachers of military medicine, in the various schools, take up the lines laid down by the government schools, so modified as to become an integral part of the college course, would the result not be gratifying? Would not the graduate of any medical school be far better prepared to accept a medical military commission, and to go at his military work in accordance with the accepted ideas of the professional military medical man of the regular establishment?

In this as in other branches of the military art, there must be a head to follow. The United States authorities issue a manual on guard duty. Why? Because it is best to have all soldiers in one commonwealth instructed alike, it prevents confusion. Let the same authorities set the criterion for the medical colleges to follow so far as it can be done. That is, let military medicine conform to accepted ideas and then promulgate these ideas throughout the medical schools. Some might say that such an idea smacks of medical militarism, that we are drifting professionally and otherwise towards militarism. Some recent experiences have shown the need of more militarism, medical and otherwise.

This country has had, and will in the future have, to maintain its place on the earth by force of arms. Anything that aids in the care of the men who have to serve the arms, helps them to serve the arms efficiently.

Every branch of the medical military service of our country is represented in this association. This association is certainly the proper body to advocate and to advance any idea that has for its object the better care of the fighting lines of our country.

The fighting line is entitled to that consideration..

Should military medical science be taught in our medical colleges? Yes!

XXXVI. HYGIENE OF NEW LEVIES IN RELATION TO SPREAD OF INFECTIOUS DISEASES.*

BY

MAJOR GEORGE W. ADAIR,

SURGEON U. S. ARMY.

"He who stumbles twice over the same stone deserves to break his shins."

In a country that depends upon its civil population for the power with which to repel invasion or to secure its rights by foreign war, the sanitary welfare of volunteer armies is of prime importance. These armies will always be large, for the strength of overpowering numbers must compensate for the deficiency in military training . The problem will always be to collect an army of two hundred thousand men and hold it in camps of instruction long enough to impart the rudiments of military life, without having it paralyzed by disease.

We have had a recent experience under most favorable conditions during our war with Spain. The camps were especially selected, in a friendly country, with excellent means of communication, with ample facilities for obtaining and forwarding supplies. The best sanitary and medical skill that the country afforded was secured for the service of the army. But in four months another army—of nurses—was needed for the care of the sick; great military hospitals were filled, and the capacity of the civil hospitals was taxed by the overflow, and many were sent directly to their homes to be nursed by their friends. It is useless to accuse local conditions and individual delinquencies, for the result was the same everywhere. Troops camped in Pennsylvania, in Virginia, in Tennessee, in Georgia, in Florida, in California, and on the shores of Lake Michigan, suffered from the same disease and in almost the same degree. Typhoid fever was a universal blight. The loss cannot be measured by the number of deaths, for the services of every man attacked by the fever were lost for that campaign.

With this unpleasant experience before us, the question is both pertinent and important. Should there be another war next summer, will this history be repeated? Without a change of methods, it most certainly will. What changes are to be made?

*This paper, under the nom de plume of "Quereus," received honorable mention by the Enno Sander Prize Committee at the Ninth Annual Meeting of the Association at New York.

What additional precautions are to be taken? In the bustle and confusion after the outbreak of hostilities, there will be no time for concerted action, such as the case requires. The necessity for thoughtful deliberation renders this a timely topic for discussion, and one on which the welfare of the country may depend. Furthermore the means required to prevent the spread of typhoid fever among new levies are those best calculated to check the spread of other camp diseases, and there is no question in military hygiene whose solution will be so far-reaching in its results.

The first fact to be considered is that there is a constant percentage of sickness in every community, and at all times; and that a part of that sickness is due to typhoid fever. It is impossible to gather a thousand men into a regiment and transport them to the camp of instruction without bringing along a little noxious leaven that without care may leaven the whole lump. It is equally certain that each victim of typhoid fever carries with him and scatters around him something that renders his vicinity dangerous. Hence the welfare of the command demands that there shall be a prompt separation of the sick from the well. To the neglect of this fundamental precaution or to ignorance of the means to efficiently carry it out, must be attributed the rapid spread of fever through our camps. There was a failure to comprehend the significance of slight ailments and a lack of provision to suitably care for them. There has been much heartburning and recrimination over errors of diagnosis that might have been assuaged by a knowledge of the two following facts. Firstly, it is impossible to make a sufficiently early diagnosis of typhoid fever; and secondly, it is not necessary. All authorities agree that it is very difficult to tell when typhoid fever begins; and when they speak of the first week of typhoid fever, they mean the first week after the patient is compelled to take to his bed. With the latest tests a positive diagnosis before the end of such first week is rare. All agree that for ten or twelve days before the patient takes to his bed, he may have slight chills, headache, mental dullness, intermittent fever and looseness of the bowels, with a gradually increasing debility. Surely the poison must be quite active that can produce such symptoms. The germs must be present in considerable numbers and rapidly developing. This preliminary stage is one of danger to the camp. How can these cases be distinguished from the dozens of slight ailments and promptly withdrawn from contact with their associates? All slight ailments must be brought under skilled observation and kept in strict seclusion until their nature is determined. The man who can undergo his drill for several

hours daily is not sick; if he fails, let him be sent at once to the Surgeon, who will take his temperature. Every man with the slightest abnormality of temperature, should be put to bed and kept there until the thermometer shows by frequent observations that his temperature has been normal for at least twenty-four hours. Every case of looseness of the bowels should be subjected to the same treatment and test. So also, with the cases of headache. This is the true function of a regimental hospital which must be fully equipped to receive and care for all such cases in complete isolation from the command. These mild cases cannot be sent to the division hospital, as it is better to limit the intercourse between regiments as much as possible. This will increase the size of the regimental hospital, but it can be rapidly reduced to the regulation allowance after two or three months, when the process of elimination is complete. The best place for every man unfit for duty is in the hospital; but from deficiency of supplies or other causes some men will be treated in quarters. Every man allowed to stay in quarters should have his temperature taken every morning and evening, and every febrile case should be sent at once to the hospital. By this process every case of typhoid fever, diphtheria, measles and mumps will be brought under the complete control of the Surgeon before it has had time to spread the infection; and the percentage of sickness, so large in new levies, will be greatly reduced.

There is room for great improvement in the method of collecting and mustering in the volunteer forces. Every state should have a tract of land of sufficient size to afford ample room for a camp and drill ground for three regiments. This should be conveniently near the state capital and have good railway facilities. This ground should be carefully surveyed, and lines for company kitchens and sinks established. Sewer and water pipes should be laid and sinks constructed with the flush tanks connected, ready for the water to be turned on when needed. Agricultural tiling should be used freely where needed, as ventilation of the subsoil is of great sanitary advantage. Such a camp ground may well be considered a fortification, for it would give a military strength to a state that depends upon the speedy conversion of its citizens into soldiers in time of need. If losses from sickness and death be computed in dollars and cents, the saving to the state at the muster of the first three regiments would be a large interest on the investment for many years. This camp ground need not be a loss in time of peace. It can be converted into a beautiful park; it may be used as a training ground for the militia; it can be turned over to an agricultural college as

an experiment station; or it may be rented to a farmer, for the more the soil is stirred, the freer it will be from injurious emanations when needed for a camp.

In the absence of such elaborate provision, the first duty of the governor, after a call for troops, will be to have his Adjutant General secure suitable sites for camps. In this case each regiment should be camped by itself, for in the aggregation of new levies the danger from infectious diseases is increased almost as the square of the numbers. Then the field and staff officers should be appointed and mustered in. The services of these officers are very important and will be needed at once. New levies need a supreme guiding head from the start. The system of mustering in the companies first was tried at the outbreak of the Spanish War and worked badly. The companies were poured in and lodged in a haphazard way to await examination and muster without any authority to devise and enforce the simplest sanitary regulations. The relative rank of the company commanders was not yet determined. If one felt entitled to command, he felt that the arrival of the next train would displace him. Heaps of human excrement, pools of urine and swarms of flies were seen at every turn. Even the floors of the building where men slept, were not exempt from defilement. There was no one to establish a restraining patrol or order a police party. Three varieties of lice were prevalent in the command before the mustering officer could complete his rolls; and it is not a great flight of imagination to suppose that disease germs were equally disseminated. By the time that the Colonel was mustered in, the camp was uninhabitable and beyond correction.

The Quartermaster must make his requisitions and have his clothing and equipment ready for issue as soon as the men are mustered in. The commissary must be prepared to issue rations at once. If the governor is wise, he will notify the authorities that he will not order the men from their homes until these supplies are ready for issue. He may so lose his reputation as an enthusiastic patriot, but he will still be respected for his practical sense. No time will be lost by his stubborn delay, for no progress can be made toward making men soldiers until these supplies are on hand. On the contrary, it takes the military spirit out of men to let them lie around for a fortnight, ragged, dirty and half barefooted. The men come in their oldest and poorest clothing, to be thrown away when they get their uniforms; this military camp is a rare spectacle; every one wishes to see it; it may be the one opportunity of a lifetime; excursion trains bring ladies from afar to view this military pageant; and the self-respecting men get ashamed and go

home, if they have not yet been mustered in. The sanitary side to this subject is still more important. Those old clothes may contain the germs of infectious disease, and the sooner they can be gotten out of camp, the less danger will there be from a spreading contagion. As soon as the men are mustered in they should be ordered to get their hair cut, take a bath, and get into the clean uniform.

The three medical officers will have important duties from the start. The senior Surgeon must obtain his medical supplies and should have authority to enlist and have mustered in at once a Hospital Corps of three stewards and at least twelve privates of whom two or three should be cooks. With this force he must pitch his tents and organize a hospital. The separation of the sick from the well must begin at once. He must have his vaccine virus ready to vaccinate each company as soon as it is mustered in. He must maintain a constant supervision over the camp, report defects at once and recommend the best remedial measures.

The two junior medical officers should be ordered to the homes of the companies to make a physical examination of the men. The United States will insist upon another examination before the men are mustered in, but this preliminary examination will save much time and expense. When the governor sends each Captain his appointment, he should also send him a blank muster-in roll with instructions, as soon as he has secured the required number of men, to enter their names upon this roll, commissioned officers first, then the sergeants, then the corporals, and lastly the privates in alphabetical order. When he reports that this roll is complete, the medical officer will be sent to examine the men. If defective men are discovered and rejected while the company is still at home, others can be obtained there more easily than at the mustering camp, where all are strangers, and delay in mustering in while hunting for a few recruits to fill the vacancies will involve further loss, as some men are sure to become disgusted and go home. Then the expense of transporting disqualified men to the place of muster and of sending them home again is a considerable loss. The medical officer who visits the homes of the companies may gain a very useful knowledge of the diseases prevailing in each locality. The work that the regimental medical officer does at this preliminary examination will save very valuable time at the final one. The regular army examiner can tell at a glance that this work has been well and faithfully done and need waste no time in verification At this preliminary examination may be entered on the roll the height, weight, complexion, the color of the hair and eyes, and

any physical defects, as missing members. The vision and hearing will be carefully tested. The surgeon will write "A" for accepted opposite each man's name whom he deems fit for military service; those rejected will be marked "R," and the cause for rejection entered in the remarks. The measurements of the chest at expiration and inspiration will be taken and recorded. If he be in doubt about any man an interrogation mark will be sufficient to attract the attention of the regular examiner and to caution the Captain to have surplus men ready in case of final rejection. If the Captain complete the roll by making the required entries, upon arrival at the camp, there can be no reason why the rolls cannot be made out, after the final examinations, the mustering-in done, the clothing, equipment and rations drawn, tents pitched, sinks dug, and the company begin a wholesome and respectable military life within forty-eight hours of arrival. The inconveniences of a delay of three weeks or a month can only be appreciated by those who have experienced them. The final examination of one hundred men, if only three minutes be given each man, requires five hours of very hard work; the preliminary examination above outlined, will give the final examiner more time to devote to important matters affecting the future efficiency of the company.

The camp is under the supervision of the senior Surgeon from the first. He must give it constant attention and strive to secure the best possible conditions, not only by written reports and recommendations, but by personal intercourse with the officers, all are zealous and willing to learn; and sanitary knowledge to be useful must be generally diffused. If the company officers know what is required and the reason for the means employed, the Surgeon will have little to do.

Where a sewer system is not provided, the sinks are always a problem in camp sanitation. They are a breeding place for disease germs and always a source of danger; but their odors may divert attention from more immediately dangerous violations of sanitary law, and thus indirectly promote the spread of infectious diseases. The best form of camp places the company streets at right angles to the line of officers' tents with the kitchens between. The sinks are then located at a convenient distance in the continuation of the company streets away from the kitchens. This organic waste must either be removed or destroyed, that is decomposed into harmless inorganic elements, at the place of first deposit. If it can be carried away by water so far that it will never be brought back by wind or tide, this is probably the best means of disposing of this organic matter. Scavengers with carts and appliances are seldom satisfactory or efficient.

As an Army cannot carry with it either a sewer system or these mechanical appliances, the medical officers must be familiar with the methods of local destruction. The Surgeon must be able to make clear suggestions concerning the location and subsequent treatment of the pits where this organic matter is deposited. The destructive means available are chemical and bacterial, the former being antagonistic to the latter. Quicklime, chloride of lime, and sulphate of iron have long been used and are fairly efficient chemical agents. To obtain a sufficient and constant supply of these articles is the practical difficulty which renders the bacterial method of destruction more generally useful except in very cold weather which prevents bacterial growth. These pits of organic refuse have been much discussed without leading to corresponding improvement. The old method of allowing the pit to become nearly full of unattenuated excrement and then putting it out of sight by shovelling upon it a foot or two of earth, is universally condemned, as the circulation of ground water and ground air carried the contamination to considerable distances and the injurious effects could not be ignored. The modern practice of digging a deep pit, and shovelling back at frequent intervals the excavated earth, filling the pit with alternate strata of filth and earth, has its slight improvement counterbalanced by the fact that each pit is sooner filled and the necessary number of pits is increased. The defect in both methods is that the organic matter is not destroyed, but preserved. After thirty years of such mistaken practice, the ancient pits at Fort Laramie were ordered to be excavated and filled with clean earth; and it is of official record that when these ancient pits were opened, the stench discommoded the entire garrison. Why had not these complex organic compounds been decomposed into harmless and inoffensive inorganic elements? The answer to this question will elucidate the whole subject. This desired decomposition is brought about by bacteria. The germs of putrefaction are only found in the topsoil; they only thrive when brought in contact with suitable nutriment and at a depth only sufficient to shield them from direct sunlight. The earth brought up from the depths of a pit is practically sterile. If the earth is moist when thrown into the pit, the contained germs are not brought into contact with the organic matter and are not stimulated to rapid growth; and they are soon smothered by the superimposed layers. To hasten the decomposition of this organic matter the topdressing of earth must contain the germs of putrefaction which are only found in the soil near the surface; the dust from a roadway is generally to be preferred. Sand and earth from the subsoil are so nearly sterile as to be useless. The

earth must be dry so that capillary attraction will take up the fluid of the mass, rich in germ food, and bring it into immediate contact with the germs to stimulate them to speedy development. This dry earth must not be kilndried, as that process would kill the germs on which the success of the method depends. It will be necessary to have a close shed in which a sufficient quantity of dry earth can be stored, so that it will be dry at all times. Without such provision, the system will fail in wet weather. The organic matter must be constantly covered with just enough earth to take up its surplus moisture, and the pits must be large enough so that the germs will not be buried too deeply for rapid multiplication by superimposed layers before their colonies have had time to permeate the mass. For this reason it would be well to have two pits for use on alternate days; or the same result could be attained by a single wide pit with a seat that could slide backward and forward.

The pit should be so covered that no puff of wind can take out scraps of soiled paper and scatter them through the camp, a possibility that has been observed. Such covering of the pit as to secure darkness, as a discouragement to flies, has been recommended; but this can be but partly effective and will be unnecessary if dry earth be constantly applied. Where the camp is to be at all permanent, the comfort of the command will require suitable buildings over the pits, which must be provided with ventilating shafts through the roofs.

The quality of the water supply will have been determined before the camp site was selected; but the Surgeon must keep a constant watch over it from its source until it is finally swallowed, and then watch for symptoms that may cast doubt upon the efficiency of his supervision. It must be remembered that water which has been sterilized by boiling, may become contaminated before it reaches the soldier. If everyone is allowed to dip his tin cup into the water, infective germs may be carried into it by the cup or blown in on camp dust while it is so frequently uncovered. Each soldier should be instructed to use his own canteen and no other; and faucets should be provided through which the canteens can be filled without danger. Drinking cups for public use should be tabooed. For use in the hospital, drinking cups of metal or porcelain are to be preferred, glass tumblers are incompatible with hot water and are frequently vehicles for the transfer of disease germs.

The company kitchens will receive frequent visits from the medical officers, who will watch not only the culinary processes, but will be there at meal times to see the distribution of the food, and will remain to observe the subsequent proceedings. Each

soldier receives his allowance of food upon the two sections of his meat ration can and has his own knife, fork, spoon, and tin cup. During our late war, of the many sanitary inspectors who went about watching the flies and sniffing for odors from the sinks, how many thought to inquire how these utensils were cleaned? One intelligent lady visitor with a housekeeper's eye, reported that she saw a barrel, half sunk in the ground, to give it permanence, which was filled with water in which the soldiers gave these articles a tepid rinsing until the waterlogged sediment was rotten. This was in a camp where typhoid fever patients were treated in quarters until the diagnosis was made, and which camp was soon abandoned on account of the rapid spread of that disease. When such a contrivance is found, if the Captain and first sergeant are shown how easily it can be converted into a barrel of typhoid culture, they will strenuously object to having the immunity of the company determined by this modification of Widal's test and will have an abundance of scalding hot water in which the soldiers' dishes and utensils will be sterilized as well as cleaned; and in excess of zeal will have the dishwater boiled again before they allow it to be scattered on the ground around the camp.

The medical officer will also have an eye for spots of waterlogged soil in the vicinity of the kitchens. These are frequently the foci for the spread of infectious disease. The best method of correction is to have the water-soaked, ill-smelling spots thoroughly spaded over to bring latent germs from beneath to near the surface, where their rapid development will hasten the destruction of the organic matter.

Venereal diseases help to impair the efficiency of new levies, and will soon attract the attention of the Surgeon. The medical officers may fold their hands and say, "The passions are strong in young men who are fit for soldiers. The women are beyond our control. We can do nothing." This is to take a very superficial view of the subject. War loosens many social ties. Of the women and girls who swarm about military camps, but a very small proportion are professional prostitutes. The bushes are full of inexperienced female volunteers who still have one virtue, they are as yet free from contagious disease. Here again the injurious leaven is in the Army itself and under the control of the medical officers. Here again there must be a prompt separation of the sick from the well. Every man afflicted with contagious disease must be put to bed in hospital and kept there until he is no longer dangerous. Here again will the test of the drills be sufficient. Every man unable to drill, must be sent to the Surgeon at once. The thermometer will dispose of the febrile

cases; the non-febrile must undergo a physical examination regardless of subjective symptoms. It is the medical officers' business to find out if the man who complains of dizziness, or headache, of pain in the side, of weakness in the back, or of lameness, has or has not a contagious venereal disease; and those who have must not be allowed to go at large. A division or general hospital—as far from camp as possible—is the best place for them. By the early separation of the sick from the well, by the conversion of the regimental hospital into a quarantine camp for the observation of suspected cases of infectious disease, by observing from the start the ordinary rules of clean living as practiced in civil life, in two months the germs of disease gathered from every highway and byway of the country should be banished from our military camps. Then the regiments can be concentrated into brigades, divisions and corps without danger from spreading epidemics; and our Army can go out to meet the enemy with health, vigor and spirit undiminished by a sanitary slip on the threshold.

XXXVII. MEDICAL DEPARTMENT OF THE NATIONAL GUARD OF PENNSYLVANIA.

BY

MAJOR J. K. WEAVER,

BRIGADE SURGEON N. G. P.

The Medical Department of the State of Pennsylvania is a separate and distinct organization in all respects from the other departments. The General Assembly of Pennsylvania during the session of 1888 and 1889 enacted a law for the reorganization, discipline and regulation of the National Guard.

The law provides that the Department shall consist of a Surgeon-General, who is Chief of the Medical Department; one Surgeon with the rank of Lieutenant-Colonel; not more than twenty Surgeons with the rank of Major; nor more than forty Assistant Surgeons with the rank of First Lieutenant. Assistant Surgeons who have served with regiments of infantry for the full term of a commission (five years) and are re-commissioned as Assistant Surgeons within six months from the expiration of former commissions, will be re-commissioned with the rank of Captain.

Appointments of Surgeons and Assistant Surgeons are made by the Commander-in-Chief upon the recommendation of the Surgeon-General, and after the applicant has passed such examination as may be required by the Surgeon-General as to character, professional ability, and physical condition.

The conditions of appointment require also, that he shall be a member in good standing in the profession, be actively engaged in practice, have practiced medicine for at least four years, be a graduate of a recognized, reputable medical college, and a member of the County Medical Society in the county in which he resides.

Examinations are conducted by a Medical Examining Board appointed by the Surgeon-General. In this way, only men of good standing, professional ability and high degree of efficiency are secured; under the old law appointments in the medical service were made by commanding officers of regiments, brigade or division commander, and were selected, not so much for their professional qualification as because they desired to enter the service, or because of social or other conditions. The guard being made up of a division, brigades and regiments, and troops of

cavalry and battalions of artillery, assignments are made accordingly. On staff of division commander, one Surgeon with rank of Lieutenant-Colonel; on staff of brigade one Surgeon with rank of Major; to each regiment of infantry, one Surgeon with rank of Major and two Assistant Surgeons, one with rank of Captain (if second commission), and one First Lieutenant. To each battery of artillery and troop of cavalry, one Assistant Surgeon with rank of First Lieutenant.

No assignments are made of medical officers except to commands within the territorial limits of which they reside.

Blank forms on which to apply for appointment are furnished by application to the Adjutant-General or Surgeon-General.

DUTIES OF MEDICAL OFFICERS.

Medical officers will keep complete files of General Orders, circulars, requisitions made or received, reports made or received, and hospital returns, and turn the same over to their successors.

Surgeons are responsible for the proper and effective management of the medical service of the command to which they may be assigned or with which they may be serving.

DIVISION AND BRIGADE SURGEONS.

Division and brigade Surgeons are required to keep a roster of the medical officers on duty in their respective commands. They will recommend for the action of the division or brigade commander such detail for hospital or special duty, or medical officers of the day, as may in their judgment be necessary. They will keep themselves thoroughly informed as to the sanitary conditions affecting the troops, the efficiency of hospitals under their charge, the efficiency of the Hospital Corps and ambulance service, and in the event of the establishment of division or brigade hospital, they will indicate the locality best suited therefor, and recommend to the commanding officer the necessary details of medical officers to properly conduct and supervise the same.

They will make proper record of all reports and communications passing through their respective offices, and in cases in which special action may be necessary, will record the same thereon by endorsement and make record of the endorsement in an endorsement book.

Official papers will be forwarded or transmitted without delay.

REGIMENTAL, BATTERY AND TROOP SURGEONS.

The Surgeons on duty with regiments of infantry will advise freely with the regimental commander on all sani-

tary matters. On the march and in the camp they will examine the sick, with a view to their proper treatment and disposition, and should inspect frequently the quarters of officers and enlisted men, kitchens and sinks. The cooking of the food for the command will receive the careful supervision of the Surgeons.

The senior Surgeon on duty with a regiment of infantry, is responsible for any unexpendable medical stores and hospital property, as well as for the proper supply of medicines, etc., which supply should be renewed as often as necessary by requisition made upon the brigade Surgeon or brigade hospital as the case may be, unless otherwise ordered. Regimental Surgeons are directly responsible for the efficiency of the Hospital Corps.

They will forward copies of the morning report of sick and wounded to the brigade Surgeon and to the regimental commander.

Their duty also is to examine all enlisted men entering the guard. This duty is performed by one or more of the regimental Surgeons, who submits them to a rigid and careful examination as to their physical condition. A blank form of examination is appended as a part of this report.

The brigade Surgeon or Surgeon of a regiment is detailed as a part of the brigade board, whose duty it is to pass upon the physical qualification of all field or line officers coming before that board.

SURGICAL AND MEDICAL SUPPLIES.

Provision has been made for the complete equipment of the surgical and medical department. A case or surgical instruments comprising such a variety of instruments as to enable the Surgeon to perform any operation which he may be called to do at any time. Care is exercised, however, not to include any unnecessary or unessential instruments. Such a case is placed in the hands of each regimental Surgeon. The case is made of aluminum, and the trays on which the instruments rest, are so arranged that they can be removed from the case at the time of an operation, and set in a sterilizing pan, which pan constitutes a part of the case; the purpose being to combine lightness with compactness and completeness.

An emergency case also is provided, which contains everything medical and surgical that may be needed in an emergency, and which because of its small size and light weight, and being always ready, can be used by the Surgeon at night or in the field during the day, during time of drill or manœuvers. This case is small in size, so arranged as to be carried in the hand or over the shoulder by a strap. It comprises hypodermic case,

containing a hypodermic instrument with a variety of tablets for hypodermic use; a small surgical case containing scalpel, forceps, scissors and probe; two first aid packages, emergency ligatures and needles and clinical thermometer. It also contains such a variety of remedies for internal use as a Surgeon would under any condition, be liable to use. The purpose in both of these cases, is to afford ample provision for every emergency or condition with which the Surgeon may meet, combined with lightness in weight, compactness of form, and convenience in the administration of remedies, and ease in transportation. These considerations are of the most important character in active service.

The medical and surgical list has been so arranged as to afford ample variety, convenience of form for administration, and in such quantities only, as will be necessary for a tour of a week's encampment, thereby promoting economy and convenience. A list of both medical and surgical supplies is attached as a part of the report. These supplies are furnished in a compact case, which is made of light wood, well seasoned and uninfluenced by weather, and so arranged as to be easy of access and convenient administration; both medical supplies and surgical dressings are in the same chest. Every article is plainly labeled, and so placed in the chest as to be convenient of access, and easily distinguished. These lists are alike for the whole division, and upon brigade Surgeons falls the duty of seeing that the cases are properly filled and delivered to the armories previous to the regiments leaving for the field of duty. The brigade Surgeon of each brigade will keep such a supply of both medical and surgical stores that he may be able to fill any requisition that may be made upon him during the encampment. This has been done for economical purposes, as well as for the purpose of securing a uniformity of medication and surgical application throughout the guard. Only the best known and the most reliable therapeutic agents and the most approved, convenient and most compact surgical dressings are used.

HOSPITAL CORPS.

While the recent law provides for a distinct medical department, there has been no provision made in the law for a Hospital Corps, other than that which has existed heretofore, viz: four privates and one hospital steward to each regiment with two privates in each company as company bearers. By mutual consent of the Adjutant-General, Surgeon-General and Surgeons of the division and brigades, a Hospital Corps has been organized, consisting of one enlisted man for each company of the regiment,

and as there are twelve companies in each regiment, thus constituting a corps of twelve men for each regiment, or four for each battalion of a regiment, and as there are fifteen regiments in the division, the total number of the Hospital Corps in the guard will be 180. The law provides that there shall not be more than three hospital stewards to a regiment, and also that there shall be acting hospital stewards. Just what relation these men shall bear to their companies while in their armories, has not yet been fully decided, but while in camp, their time is all to be given to the needs of the Hospital Corps, they shall be excused from all company duty, but mess and quarter with their company.

They shall be fully equipped as they are in the Army. Each private of the corps carrying as his field equipment, canteen, canteen strap, haversack, haversack strap, littersling, waist-belt, waist-belt plate, tin cup, knife, fork, spoon, Hospital Corps pouch, properly supplied. When one of the corps is serving as orderly, he shall carry a medical officer's pouch instead of the Hospital Corps pouch. Acting hospital stewards are chosen from the privates of the Hospital Corps by their medical officers, by whom they have been recommended as possessing the necessary qualifications. Hospital stewards are selected from acting hospital stewards who have served not less than three months in the Hospital Corps, have been recommended by their medical officers and have been approved by a board of not less than three medical officers.

Members of the Hospital Corps shall receive instruction from a medical officer for at least eight hours in every month. The instruction shall consist of lectures and demonstrations of the method of rendering first aid to the sick and wounded, of drills in the ambulance service and as litter bearers.

The practical demonstrations should teach the methods of arresting hemorrhage, of applying first aid and dressings, of making extemporized dressings for fractures, reviving those who have been under water, etc., instruction should also include the anatomy of bones, locations of great bloodvessels, the treatment of faintness, heat, exhaustion, sunstroke, etc.

The Hospital Corps as thus constituted, while complete and serving good purpose, we do not think is the ideal organization, and we trust is but temporary, and we cherish the hope that the next session of our legislature will make such provision for a large and completely equipped corps, made up of three companies, properly officered, which shall be distributed throughout the State, one in the middle, and one in the eastern and western sections. Such an arrangement would insure a more intelligent

class of men, more capable of instruction, and therefore better drilled, and in every way better prepared to discharge intelligently and efficiently the variety of duty incumbent upon the Hospital Corps men.

LITTERS.

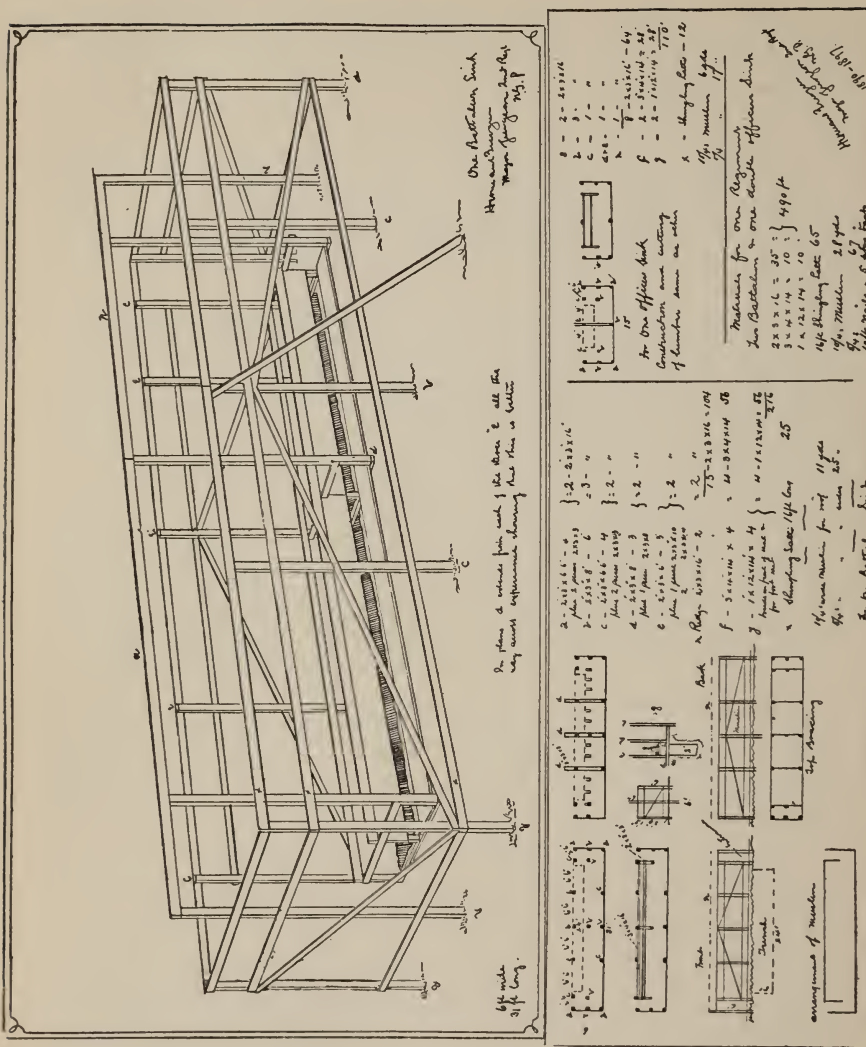
A litter has been adopted by the guard, differing in some respects from that used by the Army, as to weight, material and construction, insuring more security and bearing harder usage. A complete description of this litter is appended as part of the report.

One of the most important considerations in an encampment of soldiers, whether temporary or permanent, is the sanitary provision made for the protection and health of the command. This includes an ample supply of pure water, elevated and dry ground, good drainage, and the proper disposal of the refuse of the camp from kitchens, etc., and a proper regard for the location, proper disinfection, construction and hygienic care of the sinks.

These conditions obtained whether the camp be one at home or in the field, in any land or in any clime. I desire to submit for the judgment of the Association, a plan of a sink which has been adopted by the guard, and is to be applied throughout the division. The sinks are to be of the same material, size and construction and located with regard to the regiments, uniformly, and at as protected points as possible. They are to be either in regimental or battalion form, or for officers; protection to the sides and the roof being made by unbleached muslin, and canopy or cover of the same material. They are symmetrical, pleasing to the sight and afford convenience for all alike. We believe that the adoption of such an inexpensive sink,easy of construction and of material easily secured, worthy of consideration.

I submit herewith a plan in outline of such sink, with such detail of material and construction as will enable any of the Surgeons to understand in a few minutes.

As the purpose in the reorganization of the medical department is to increase its efficiency, and to provide for any contingency that might arise in the future, whether at home or abroad, the idea has been, to keep as closely as possible to the standard as to men and material and equipment of that of the medical department of the Army. Only such men are enlisted as are free from all physical defects, of good form and active movements, and especially perfect as to teeth, hearing and vision. The equipment is to be as thorough and complete as possible. The surgeons are to be as efficiently qualified as possible, as Surgeon and as medical man, and the Hospital Corps is to be



made up of men selected specially for that duty, so that whatever may be the future of our country as to war, foreign or domestic, the National Guard of Pennsylvania will be able to furnish soldiers of such perfection of organization, equipment and intelligence as that it will only be necessary to have them transferred from the guard to the National service as a regiment,

brigade or division, commanded by our own skillful, experienced officers.

LIST OF SURGICAL SUPPLIES FOR ABOUT 600 MEN FOR ONE WEEK.

1 Regimental Case for Camp Use, containing the following:
½ doz. Gauze Bdges. 3½x10.
1 doz. Gauze Bdges. 3x10.
1 doz. Gauze Bdges. 2x10.
½ doz. Gauze Bdges. 1x10.
½ doz. Gauze Bdges. 1½x10.
½ doz. Unblea. Bdges. 3x5.
1-12 doz. asstd. pkgs. Silk.
1-oz. Styptic Cotton.
2 doz. No. 2 Safety Pins.
2 doz. No. 3 Safety Pins.
1 bottle 50 Antiseptic Tablets.
1 lb. Abs. Cotton, ¼ lbs.
4 oz. Abs. Cotton, 1 oz. compressed.
3 U. S. First Aid Packets.
5 1 yd. A-T. Cartons 10% Iodo. Gauze.
12 1 yd. A-T Cartons, Plain Gauze.
¼ doz. Spools 1 in. Adh. Plaster.
1-12 doz. spools 2 in. Adh. Plaster.
1 yd. roll plain Belladonna Plaster.
2 10-leaf Mustard Plasters, cloth.
1 yd. Silk Isinglass Plaster.
2 doz. 1½ in. Cotton Mops.
¼ doz. 16 in. S-R Solid End Cath.
¼ doz. Lee's Lens Therm., Cert.
2 Pyramids of Pins.
2 doz. Med. Abs. Gauze Sponges.
1 H-R Iodo. Duster, Bismuth Formic Iodide Comp.
1 Slide Case Silk Worm Gut, 25 each.
1 yd. Roll Tar Paper or Muslin.
1 Bottle Liniment Tablets.
Graduate, 2 ounces.
Soap, Carbolized.
Soap, Plain.

LIST OF REMEDIES FOR A WEEK'S ENCAMPMENT FOR 600 MEN.

Quiniæ and Capsici ¼ gr.	500
Quinia Sulph. 2 grs.	1000
Strychnia Sulph. 1-30 gr.	500
Iron, Arsenic and Strych. No. 2.	500
Anti-Dyspeptics	500
Pil. Aloin Comp.	500

Calomel (1/8 gr.) Sodæ (1 gr.) and Ipecac (1/8 gr.) .. 500
Aperient Salt, 1 doz. oz. bottles.
Diarrhœa No. 2. 500
"Sun" Cholera 500
Bismuth Sub-Gallate 5-gr. 500
Sodæ Mint 500
Salol 2½ gr. 100
Zinc Sulphate, 5 gr. 500
Fever Improved (Kenyon) 500
Migraine 500
Dovers Powders, 5 gr. 500
Sodium Bromide, 5 gr. 500
Tinct. Gelsemium, 5 gr. 500
Morphia Sulph. 1/8 gr. 100
Sodæ Salicylate, 5 gr. 500
Salol Comp. 500
Cardiac Tonic (Da Costa) 500
Tonsilitis 500
Boracic Acid, 5 gr. 500
Chlorate of Potassa and Soda 500
Brown Mix. and Muriate of Ammonia, 1 gr. 500
Potass. Iodide, 5 grs. 200
Iodine in Crystal for making Tinct.
Potass. Permanganate, 1 gr. 500
Zinc Sulpho. Carbolate Comp. 500
Brown Mixture 500
Coryza No. 1 500
Cocaine Tablets for solution, 1 vial.
Atropia Sulph. for solution, 1 bottle.
Chloroform, one pint.
Ether Sulphuric, 2 pints.
Alcohol, 1 pint.
Spts. Frumenti, 1 pint.
Glycerine, 4 ozs.
Folding Cartons, small size.
Lunar Caustic, 1 stick.
Pipettes.

HYPODERMATICS.

Morphia (¼ gr.) and Atropia (1-150 gr.)
Strych. Nitrate, gr. 1-40.
Digitalin, 1-50 Comp.
Local Anæsthesia.
Apomorphia.
Trinitrin, gr. 100.
2 small Spatulas.

LITTER.

Description of the stretcher used by the National Guard of Pennsylvania and made at the State Arsenal, Harrisburg, Pa.

RAILS.

Seven feet and three inches, by one and one half inches square, neatly rounded to four handles, made of white ash well seasoned, and finished with three coats of hard wood oil.

FEET.

Width on rail seven inches, two inch shoulder on each side, width between bend of shoulders or commencement of foot, three inches.

Depth from bottom of rail to top of foot, five inches, width of widest part of bow five and one-half inches.

Made of the best hammered hoop iron one-sixteenth inch thick, by one and one-half inches wide. Feet are fastened to rails by wood screw in front and bolt and nut in rear with counter sunk head.

HINGES.

Best rolled steel, one and one-fourth inches wide, one fourth thick and twenty-one and five-eighth inches long, divided in center and clasped by a three-eighth rivet, with flanges on both ends to act as guides in folding and opening, the outer ends are turned sufficiently round to allow passing the back of the foot, and fastened to rails by bolts two and one-half by one-fourth inches, through the shoulder of the foot, the heads of the bolts countersunk in the tops of the rails.

SUPPORTING STRAPS.

Seven inches from each hinge towards center a leather strap three feet long and three-fourths of an inch wide is countersunk in top of rail and firmly secured by screws, directly opposite a buckle attached to a short strap secured in same manner, when the stretcher is open the straps act as supports, when closed they are used for strapping it together.

CHECK.

To check the hinge when folding from overlapping the rails, a stout half round headed screw is fastened in the rail one inch from the foot, this keeps the hinge in its proper place when stretcher is folded.

CANVAS.

The frame work of stretcher is covered with fifteen-ounce, brown canvas edge double one-inch and let into the rails, and neatly secured by small wire staples.

In the center of stretcher N. G. P., is stamped. The stretcher carrier is made of fibre dyed duck, eight ounce, double, with patent fasteners and leather sewed in loops which slip over the handles of litter.

Weight 17½ pounds, test, eight hundred (800) pounds.

APPENDIX.

Association of Military Surgeons

OF THE UNITED STATES.

CONSTITUTION AND BY-LAWS.

REVISED JUNE 1, 1900.

Preamble.

The Military Surgeons of the United States, in order to promote and improve the science of Military Surgery, have associated themselves together and adopted the following Constitution and By-Laws:

CONSTITUTION.

ARTICLE I.

Name.

The organization shall be known as "The Association of Military Surgeons of the United States."

ARTICLE II.

Members.

Section 1. There shall be Active, Associate, Honorary, Corresponding, and Life Members.

ACTIVE MEMBERS.

Sec. 2. Commissioned medical officers of the United States Army, of the Navy, of the Marine Hospital Service, of the National Guard, or Volunteer Militia of the several States, of the United States Volunteers and acting assistant or contract Surgeons of the United States Army, are eligible for active membership. Active members may retain their membership should they be honorably discharged from the service in which they were commissioned. Active members only shall be eligible for office or entitled to vote.

ASSOCIATE MEMBERS.

SEC. 3. Ex-medical officers and other officers of either of the above-mentioned services, and of the Marine Hospital Service, and ex-medical officers of the United States Volunteer Service are eligible for associate membership.

HONORARY MEMBERS.

SEC. 4. Persons who are not qualified for active membership, but who have achieved distinction in the military service, are eligible as honorary members.

CORRESPONDING MEMBERS.

SEC. 5. Military Surgeons living outside of the United States, who are prominent in the literature of military medicine and hygiene, are eligible as corresponding members.

LIFE MEMBERS.

SEC. 6. On payment of the sum of Fifty Dollars any active member may become a life member and be exempt from further dues.

ARTICLE III.

Officers and Committees.

OFFICERS.

SEC. 1. The officers shall be a President, two Vice-Presidents, a Secretary and a Treasurer, who shall hold their respective offices until their successors are elected and qualified.

COMMITTEES.

SEC. 2. There shall be the following Standing Committees: An Executive Committee, to consist of the officers and vice-presidents, and five (5) members. A Publication Committee, to consist of three (3) members, one of whom shall be the Secretary as *ex-officio* Chairman. A Literary Committee, to consist of seven (7) members, four (4) members from the National Guard, State Troops or Militia, and one (1) each from the Army, Navy and Marine Hospital Service. A Nominating Committee, based upon a representative or one vote for each State, Territory, the Army, the Navy and Marine Hospital Service, and for every additional ten (10) members or major fraction thereof an extra representative or vote; said vote or votes to be cast by a member or members, present from each State, Territory, Army, Navy and Marine Hospital Service, to be designated by the members present from each State, Territory, Army, Navy and Marine Hospital Service at the time of meeting.

ARTICLE IV.

Quorum.

Thirty-five (35) members shall constitute a quorum for the transaction of business, but a less number may adjourn.

ARTICLE V.

Amendments.

All amendments to this Constitution and By-Laws shall be proposed in writing at one annual meeting, and voted on at the next. A three-fourths vote of all the members present at the annual meeting shall be necessary for adoption.

BY-LAWS.

ARTICLE I.

Election to Membership.

SEC. 1. Election to active or associate membership shall be by the Executive Committee, to whom the Secretary shall refer all applications, together with such credentials as may be presented.

SEC. 2. Election to honorary or corresponding membership shall be by a two-thirds vote of the Association, after the unanimous recommendation of the Executive Committee.

ARTICLE II.

Loss of Membership.

Any member who may be dismissed from the service for conduct unbecoming an officer and a gentleman shall be expelled and debarred from any further rights or privileges when proper proof has been furnished the Secretary.

ARTICLE III.

Meetings.

The Association shall meet annually, the time and place to be fixed at each meeting for the one ensuing. Special meetings may be called by the President at any time. At the annual meeting the President, Vice-Presidents, Secretary and Treasurer shall be elected for the term of one year, the standing committees appointed, and the annual reports received.

ARTICLE IV.

Dues.

The dues to be paid by active and associate members shall be five dollars ($5.00), due at the time of election; thereafter on January 1 of each year, in advance. Delinquents in the payment of dues will not be entitled to the Proceedings or other publications of the Association.

Delinquency for two years shall terminate membership, after due notice by the Treasurer.

No one formerly a member of the Association, who shall have allowed his membership to lapse by non-payment of dues, shall be reinstated before paying all arrears.

Honorary, Corresponding and Life members shall be exempt from the payment of dues.

ARTICLE V.

Duties of Officers.

THE PRESIDENT.

SEC. 1. The President shall preside at all meetings, appoint all committees, unless otherwise provided for, approve all proper bills, and perform such other duties as are usually incumbent upon such an officer.

THE VICE-PRESIDENTS.

SEC. 2. The Vice-Presidents, in order of seniority, shall perform the duties of President in the absence or inability of that officer.

THE SECRETARY.

SEC. 3. The Secretary shall keep the records and archives, issue certificates of membership to honorary and corresponding members on election, to active and associate members when notified by the Treasurer that the proper dues have been paid.

He shall present to the Committee on Publication a synopsis of the proceedings, and such papers as the authors desire to have published by the Association. He shall receive all applications for membership and refer the same to the Executive Committee. He shall notify the Treasurer of the election of active and associate members, and shall prepare an annual report. At each annual meeting he shall appoint an Assistant Secretary.

THE TREASURER.

SEC. 4. The Treasurer shall receive all moneys due the Association, collect all assessments, and pay all bills which have been properly approved. He shall have charge of all publications, and distribute the same to those who are entitled to them. He shall notify the Secretary when new active and associate members have paid and are entitled to certificates of membership.

The accounts of the Treasurer shall be audited by a committee appointed for that purpose on or before the annual meeting. He shall present an annual report.

He shall execute such bond of $2,000 as may be approved by the Executive Committee for the faithful performance of his duties; the Association to bear the cost of this insurance.

ARTICLE VI.

Duties of Committees.

THE EXECUTIVE COMMITTEE.

SEC. 1. The Executive Committee shall perform the duties prescribed by the Constitution and By-Laws, and such other administrative or executive duties as may be referred to it, and for which provision has not otherwise been made. The President shall be *ex-officio* chairman.

THE PUBLICATION COMMITTEE.

SEC. 2. The Publication Committee shall determine what portions of the proceedings are of sufficient general interest to be printed.

It shall also decide on the advisability of publishing the various papers presented at the annual meeting, and shall prepare for publication,

contract for printing and see through the press all such papers in a volume of Annual Transactions; but all contracts for printing must first have the approval of the President and Treasurer.

THE LITERARY COMMITTEE.

SEC. 3. The Literary Committee shall outline the literary work for the annual meeting in advance, making the necessary arrangements for the reading and discussion of papers.

THE NOMINATING COMMITTEE.

SEC. 4. The Nominating Committee shall, at the annual meeting, present a list of candidates for the various offices for the ensuing year.

The vote, or votes, of the Nominating Committee shall be cast by a member, or members, who shall be designated by the members present, from each State or Territory, the Army, the Navy, and the Marine Hospital Service.

OFFICERS OF THE ASSOCIATION FROM ITS ORGANIZATION.

1891.

FIRST MEETING HELD AT LELAND HOTEL, CHICAGO, ILL., SEPT. 17-18, 1891, BRIG. GEN. NICHOLAS SENN, SURGEON GENERAL OF WISCONSIN, PRESIDING.

1891-1892.

SECOND MEETING HELD AT MEMORIAL HALL, ST. LOUIS, MO., APRIL 19, 20 AND 21, 1892.

President—Nicholas Senn, Brig. Gen. and Surg. Gen., Wis.

First Vice-President—Nelson H. Henry, Major and Surgeon, N. G. S. N. Y.

Second Vice-President—E. Chancellor, Lt. Col., Med. Director, N. G. Mo.

Secretary—F. L. Matthews, Col. and Surg. Gen., N. G. Ill.

Cor. Secretary—Ralph Chandler, Lt. and Asst. Surg., Wis. N. G.

Treasurer—Francis J. Crane, Col. and Surg. Gen., Colorado.

Chairman Com. of Arrangements for 1892—E. Chancellor, Lt. Col. and Med. Dir., N. G. Mo.

1892-1893.

THIRD MEETING HELD AT RUSH MEDICAL COLLEGE AND THE U. S. GOVERNMENT BUILDING, WORLD'S FAIR, CHICAGO, ILL., AUG. 8, 9 AND 10, 1893.

President—Nicholas Senn, Col. and Surg. Gen., N. G. Ill.

Honorary President—C. R. Greenleaf, Lt. Col. and Dep. Surg. Gen., U. S. A.

First Vice-President—Nelson H. Henry, Major and Surgeon, N. G. S. N. Y.

Second Vice-President—C. M. Woodward, Lt. Col. and Surg. Gen., Mich.

Secretary—E. Chancellor, Lt. Col. and Med. Director, N. G., Mo.

Cor. Secretary—Ralph Chandler, Lt. and Asst. Surg., Wis. N. G.

Treasurer—Francis J. Crane, Col. and Surg. Gen., Colorado.

Chairman Com. of Arrangements for 1893—Charles Adams, Major and Surg., N. G. Ill.

1893-1894.

FOURTH MEETING HELD AT THE NATIONAL THEATRE AND THE NATIONAL MUSEUM, WASHINGTON, D. C., MAY 1, 2 AND 3, 1894.

President—Nicholas Senn, Col. and Surg. Gen., N. G. Ill.

First Vice-President—B. J. D. Irwin, Col. and Asst. Surg. Gen., U. S. A.

Second Vice-President—Louis W. Read, Col. and Surg. Gen., N. G. Pa.

Secretary—E. Chancellor, Lt. Col. and Med. Director, N. G. Mo.

Assistant Secretary—Julian M. Cabell, Capt. and Asst. Surg., U. S. A.

Treasurer—Lawrence C. Carr, Major and Surg., Ohio N. G.

Chairman Com. of Arrangements for 1894—George Henderson, Major and Surg. Gen., D. C.

1894-1895.

FIFTH MEETING HELD AT THE STAR THEATRE AND ALUMNI HALL, UNIVERSITY OF BUFFALO, BUFFALO, N. Y., MAY 21, 22 AND 23, 1895.

President—George M. Sternberg, Brig. Gen. and Surg. Gen., U. S. A.

First Vice-President—Louis W. Read, Col. and Surg. Gen., N. G. Pa.

Second Vice-President—Albert L. Gihon, Med. Director, U. S. N.

Secretary—E. Chancellor, Lt. Col. and Med. Director, N. G. Mo.

Assistant Secretary—Julian M. Cabell, Capt. and Asst. Surg., U. S. A.

Treasurer—Lawrence C. Carr, Major and Surg., Ohio N. G.

Chairman Com. of Arrangements for 1895—Albert H. Briggs, Major and Surg., N. G. S. N. Y.

1895-1896.

SIXTH MEETING HELD AT THE BROAD STREET THEATRE, HOTEL WALTON, UNIVERSITY OF PENNSYLVANIA, AND UNION LEAGUE CLUB, PHILADELPHIA, PA., MAY 12, 13 AND 14, 1896.

President—Louis W. Read, Col. and Surg. Gen., N. G. Pa.

First Vice-President—Albert L. Gihon, Med. Director (Retired), U. S. N.

Second Vice-President—Charles H. Alden, Asst. Surg. Gen., U. S. A.

Secretary—E. Chancellor, Lt. Col. and Med. Director, N. G. Mo.

Treasurer—Lawrence C. Carr, Major and Surg., Ohio N. G.

Editor—Philip F. Harvey, Major and Surgeon, U. S. A.

Chairman Com. of Arrangements for 1896—J. Wilks O'Neill, Major and Surg., N. G. Pa.

1896-1897.

SEVENTH MEETING HELD AT THE HIGH STREET THEATRE, THE OHIO SENATE CHAMBER, STARLING MEDICAL COLLEGE AND COLUMBUS BARRACKS, COLUMBUS, OHIO, MAY 25, 26 AND 27, 1897.

President—Albert L. Gihon, Medical Director (Commodore, Ret.), U. S. N.

First Vice-President—Edward J. Forster, Brig. Gen. and Surg. Gen. Mass. V. M.

Second Vice-President—John Van R. Hoff, Major and Surgeon, U. S. A.

Secretary—Herman Burgin, Major and Surgeon, N. G. Pa.

Assistant Secretary—James E. Pilcher, Captain and Asst. Surg., U. S. A.

Treasurer—James J. Erwin, Captain and Asst. Surg., Ohio N. G.

Editor—Charles C. Foster, Major and Surgeon, Mass. V. M.

Chairman Com. of Arrangements for 1897—Henry M. I. W. Moore, Major and Surgeon, Ohio N. G.

1897-1899.

EIGHTH MEETING HELD AT CONVENTION HALL AND COMMERCIAL CLUB, CHAMBER OF COMMERCE BUILDING, KANSAS CITY, MO., SEPT. 27, 28 AND 29, 1899.

President—Jefferson D. Griffith, Lt. Col. and Med. Dir., N. G. Mo.

First Vice-President—John Van Rensselaer Hoff, Maj. and Surg., U. S. A.

Second Vice-President—John C. Wise, Med. Insp. (Comdr.), U. S. N.

Secretary and Editor—James E. Pilcher, Capt. and Asst. Surg., U. S. A.

Treasurer—James J. Erwin, Captain and Asst. Surg., Ohio N. G.

Assistant Secretary—W. A. Westervelt, Capt. and Asst. Surg., O. N. G.

Chairman Com. of Arrangements for 1899—Blencowe E. Fryer, Lt. Col. and Dep. Surg. Gen. (Ret.), U. S. N.

1899-1900.

NINTH MEETING HELD AT ACADEMY OF MEDICINE, NEW YORK CITY, MAY 30, 31 AND JUNE 1, 1900.

President—Charles H. Alden, Col. and Asst. Surg. Gen., U. S. A.

First Vice-President—George Cook, Brig. Gen. and Surg. Gen. (Ret.), N. G., N. H.

Second Vice-President—George W. Woods, Capt. and Med. Dir., U. S. N.

Treasurer—Herbert A. Arnold, Lt. and Asst. Surg., N. G. Pa.

Secretary—Charles Adams, Lt. Col. and Asst. Surg. Gen., I. N. G.

Assistant Secretary—S. C. Stanton, Lt. and Asst. Surg., I. N. G.

Chairman Com. of Arrangements for 1900—A. H. Briggs, Maj. and Surg., N. G. N. Y.

REGISTER OF MEMBERS.

REVISED TO APRIL 15, 1901.

NOTE.—The figures preceding each name in the Register of Members, indicate the year of election to membership.

The designations after the name indicate (first) the grade of Military and Naval precedence, (second) the Corps Title, and (third) the service, State or National, in which commissioned. In the case of Naval Officers the grades are in brackets, indicating what is termed their "relative rank;" they are addressed officially by their corps titles, but in social intercourse it is customary in the Navy to address them simply as "Doctor." The following table exhibits the correspondence of grades and titles in the Army and Navy:

ARMY.		NAVY.	
Grades.	Titles.	Grades.	Titles.
Brig.-General.	Surg.-General.	Commodore.	Surg.-General. Med. Dir. (ret'd.)
Colonel.	Asst. Surg.-General.	Captain.	Med. Director.
Lt.-Colonel,	Dep. Surg.-General.	Commander.	Med. Inspector.
Major.	Surgeon.	Lt.-Commander.	Surgeon.
Captain.	Asst. Surg. (after passing.)	Lieutenant	Surgeon.
1st Lieut.	Asst. Surgeon.	Lt. j.(unior) g.(rade.)	Pd. Asst. Surg.
		Ensign.	Asst. Surgeon.

In addressing communications to military officers both the grade and title are used; in addressing naval officers, the latter only is employed, e. g.:

Major A***B***C***,
Surgeon, U. S. Army,
Fort D***, Ariz.

Surgeon F***G***A***, U. S. N.;
U. S. S. I***,
Naples, Italy.

LIFE MEMBERS.

ELECTED.

1892 Adams, Charles, Lt.-Col. and Asst. Surg.-Gen., I. N. G.,
Secretary, 1899-01. 100 State St., Chicago, Ill.

1891 Alden, Charles Henry, Col. and Asst. Surg.-Gen. (Ret.), U. S. A.,
President, 1899-00.
Second Vice-Pres., 1895-96. Newtonville, Mass.

1891 Chancellor, Eustathius, Lt.-Col. and Med. Dir., N. G., Mo.,
Secretary, 1892-96. Oriel Bldg., Sixth and Locust Sts.,
Second Vice-Pres., 1891-92. St. Louis, Mo.

ELECTED.		
1894	Pilcher, James E., *Secretary and Editor, 1897-98. Asst. Secretary, 1896-97.*	Capt. and Asst. Surg., U. S. A., Carlisle, Pa.
1891	Senn, Nicholas, *President, 1891-94.*	Col. and Surg.-Gen., I. N. G., 532 Dearborn Ave., Chicago, Ill.
1899	Wesley, Allen A.,	Capt. and Asst. Surg., I. N. G., 3102 State St., Chicago, Ill.

ACTIVE MEMBERS.

ELECTED.		
1894	Abbe, Edward Harper,	Lt. (j. g.) and Asst. Surg., N. B., M. V. M., 405 County St., New Bedford, Mass.
1895	Adair, George William,	Maj. and Surg., U. S. A., Fort Sheridan, Ill.
1891	Adams, Charles Francis,	Capt. and Asst. Surg., N. G., N. J., 229 Union St., Hackensack, N. J.
1898	Allen, Arthur West,	Maj. and Surg., N. G., Minn., Austin, Minn.
1900	Allers, Henry,	Maj. and Surg., N. G., N. J. 300 Davis Ave., Harrison, N. J.
1895	Allen, Gardner Weld,	Lt.-Cmdr. and Surg., 1st N. B., M. V. M., 417 Boylston St., Boston, Mass.
1891	Almy, Leonard Ballou,	Lt.-Col. and Med. Dir. (Ret.), N. G., Conn., 173 Washington St., Norwich, Conn.
1895	Altree, George Herbert,	Act. Asst. Surg., U. S. M.-H. S., Port Tampa, Fla.
1899	Ames, Azel,	Maj. and Brig. Surg., U. S. V., Wakefield, Mass.
1894	Ames, Howard Emerson,	Surg. (Lt.), U. S. N., Newport News, Va.
1894	Anderson, Frank,	Surg. (Lt.), U. S. N., Naval Hosp., Yokohoma, Japan.
1900	Angney, Wm. Muir,	1st Lt. and Asst. Surg., N. G. Pa., 423 S. 15th St., Philadelphia, Pa.
1893	Anthony, Frank,	Maj. and Surg., I. N. G., First Ave., Sterling, Ill.
1893	Appel, Daniel Mitchell,	Maj. and Surg., U. S. A., Fort Bayard, New Mexico.
1896	Archibald, O. Wellington,	Col. and Surg.-Gen., N. D. N. G., Jamestown, N. D.
1895	Arnold, Herbert A., *Treasurer, 1899-01.*	1st Lt. and Asst. Surg., N. G., Pa., Ardmore, Pa.
1896	Arnold, Will Ford,	P. A. Surg. (Lt. j. g.), U. S. N., 1421 Masonic Temple, Chicago, Ill.
1898	Artaud, Frank Edward,	Maj. and Surg., La. V. I., New Iberia, La.
1895	Ashenfelter, William J.,	Maj. and Surg., N. G., Pa., Pottstown, Pa.
1897	Ashley, Maurice C.,	1st Lt. and Asst. Surg., N. G., N. Y., Middletown, N. Y.

Elected.		
1897	Ashmun, George C.,	Maj. and Surg., O. N. G., 94 Republic St., Cleveland, O.
1897	Austin, Charles S.,	Maj. and Surg., N. G. Mo., Carrollton, Mo.
1900	Austin, H. W.,	Surg., U. S. M.-H. S., 410 Chestnut St., Philadelphia, Pa.
1894	Bache, Dallas,	Col. and Asst. Surg.-Gen., U. S. A., Surg.-Gen'l's Office, Washington, D. C.
1895	Baker, John Walter,	Surg. (Lt.), U. S. N. (Ret.), Aurora, Ind.
1892	Baker, Washington Hopkins,	Maj. and Surg. (Ret.), N. G., Pa., 1610 Sumner St., Philadelphia, Pa.
1894	Balch, Lewis,	Maj. and Surg., N. G., N. Y., 14 Washington Ave., Albany, N. Y.
1896	Banister, John Monro,	Maj. and Surg., U. S. A., West Point, N. Y.
1895	Barber, George Holcomb,	P. A. Surg. (Lt. j .g.), U. S. N., U. S. N. Academy, Annapolis, Md.
1892	Barker, Christopher F.,	Maj. and Surg., R. I. M., 32 Bull St., Newport, R. I.
1892	Barnes, Algernon S.,	Brig.-Gen. and Surg.-Gen. (Ret.), N. G., Mo., 5434 Maple Ave., St. Louis, Mo.
1898	Barney, Reuben, Jr.,	Capt. and Asst. Surg., N. G., Mo., Chillicothe, Mo.
1900	Barns, Cass Grove,	Col. and Surg.-Gen., N. G., Neb., Albion, Neb.
1897	Barry, William Francis,	1st Lt. and Asst. Surg., R. I. M., Woonsocket, R. I.
1899	Barstow, James Mason,	Lt.-Col. and Dep. Surg.-Gen., N. G., Ia., Council Bluffs, Ia.
1894	Battle, Samuel Westray,	Maj. and Asst. Surg.-Gen., N. C. P. A. Surg. (Lt. j. g.) (Ret.), U. S. N., Asheville, N. C.
1894	Bayles, George,	Ex-Maj. and Surg. N. Y. Vol. Heavy Art., 408 Main St., Orange, N. J.
1896	Belcher, William Nathan,	Capt. and Asst. Surg., N. G., N. Y., 25 Portland Ave., Brooklyn, N. Y.
1895	Bell, Robert Eddy,	2d Lt. Amb. Corps, M. V. M., Lowell, Mass.
1893	Benedict, John Mitchell,	Ex-Maj. and Surg., N. G., Conn., 81 N. Main St., Waterbury, Conn.
1898	Benton, Frederick Leslie,	Asst. Surg., U. S. N., Care Navy Dept., Washington, D. C.
1900	Berkley, George Carlton,	Maj. and Surg., N. G., Vt., 130 Main St., St. Albans, Vt.
1893	Bertolette, Daniel Nicholas,	Surg. (Lt.), U. S. N., Navy Yard, Washington, D. C.
1895	Beyer, Henry Gustav,	Surg. (Lt.), U. S. N., Navy Yard, Boston, Mass.
1895	Birmingham, Henry P.,	Maj. and Surg., U. S. A., Manila, P. I.

ELECTED.		
1894	Blackwood, Norman Jerome,	P. A. Surg. (Lt. j. g.), U. S. N., Naval Hospital, Philadelphia, Pa.
1900	Blademan, Robert Sylvester,	P. A. Surg. (Lt. j. g.), U. S. N., U. S. Naval Hospital, Newport, R. I.
1895	Blood, Robert Allen,	Brig.-Gen. and Surg.-Gen., M. V. M., 39 High St., Charlestown, Mass.
1897	Blubaugh, Charles B.,	Lt.-Col. and Med. Dir., W. Va. N. G., 1010 Murdock Ave., Parkersburg, W. Va.
1895	Boeckmann, Eduard,	Lt.-Col. and Asst. Surg.-Gen., N. G., Minn. (Ret.), Lowry Arcade, St. Paul, Minn.
1900	Bogart, Arthur Henry,	Capt. and Asst. Surg., N. G., N. Y., 139 Seventh Ave., Brooklyn, N. Y.
1895	Borden, William Cline,	Capt. and Asst. Surg. U. S. A., Washington Barracks, D. C.
1894	Boyd, John C.,	Medical Inspector (Comdr.), U. S. N., Washington, D. C.
1895	Boyd, Robert,	Asst. Surg. U. S. N., U. S. Naval Hospital, Philadelphia, Pa.
1891	Bradbury, Bial Francisco,	Maj. and Surg., Me. V. M., Norway, Me.
1896	Bradley, Alfred E.,	Capt. and Asst. Surg., U. S. A., St. Paul, Minn.
1895	Bradley, George Perley,	Medical Inspector (Cmdr.), U. S. N., Naval Hosp., Mare Island, Cal.
1891	Brannen, Dennis J.,	Capt. and Asst. Surg., N. G., Ariz., Flagstaff, Ariz.
1892	Briggs, Albert Henry,	Maj. and Surg., N. G., N. Y., 267 Hudson St., Buffalo, N. Y.
1898	Brodrick, Richard Godfrey,	P. A. Surg., U. S. N., 1037 Fifth Ave., New York, N. Y.
1900	Brokaw, William F.,	Lt. and Surg., N. B., O. N. G., 1040 Willson Ave., Cleveland, Ohio.
1897	Brooke, John,	Maj. and Surg. (Ret.), U. S. A., Radnor, Pa.
1900	Brooks, Harlow,	Capt. and Asst. Surg., N. G., N. Y., 7th Regt. Armory, New York, N. Y.
1894	Brown, Orland J.,	Maj. and Surg., M. V. M., North Adams, Mass.
1900	Brownell, Carl DeWolf,	P. A. Surg., U. S. N., Bristol, R. I.
1895	Brubaker, John L.,	1st Lt. and Asst. Surg., N. G., Pa., 1224 4th Ave., Altoona, Pa.
1898	Bruce, Charles E.,	Maj. and Surg. (Ret.), N. G., N. Y., 176th St. and Amsterdam Ave., New York, N. Y.
1898	Brugman, Albert Ferdinand,	1st Lt. and Asst. Surg., N. G., N. Y., Hotel Endicott, New York, N. Y.
1895	Brush, Edmund Cone,	Brig.-Gen. and Surg.-Gen., O. N. G., Zanesville, O.
1891	Bryant, Joseph Decatur,	Brig.-Gen. and Surg.-Gen. (Ret.), N. G., N. Y., 54 W. 36th St., New York, N. Y.

ELECTED.		
1893	Budlong, John Clark,	Brig.-Gen. and Surg.-Gen. (Ret.), R. I. M., 604 Westminster St., Providence, R. I.
1895	Bunts, Frank Emory,	Capt. and Asst. Surg., O. N. G., 275 Prospect St., Cleveland, O.
1900	Burbank, Thomas Sparrow,	Lt. and Surg., N. R., N. G., N. C., Wilmington, N. C.
1896	Burgin, Herman, *Secretary, 1896-97.*	Maj. and Surg., N. G., Pa., Germantown, Pa.
1895	Byrne, Charles C.,	Col. and Asst. Surg.-Gen., U. S. A., Governor's Island, New York, N. Y.
1899	Calef, J. Francis,	Brig.-Gen. and Surg.-Gen., N. G., Conn., Middletown, Conn.
1897	Campbell, William Francis,	1st Lt. and Asst. Surg., N. G., N. Y., 127 Lafayette Ave., Brooklyn, N. Y.
1897	Carpenter, Dudley Newcomb,	Asst. Surg. (Lt. j. g.), U. S. N., Navy Yard, Boston, Mass.
1899	Carr, E. Arthur,	Maj. and Surg., Neb. N. G., 1205 O St., Lincoln, Neb.
1893	Carr, George Wheaton,	Lt.-Col. and Med. Dir. (Ret.), R. I. M., 27 Waterman St., Providence, R. I.
1894	Carrington, Charles Venable,	Capt. and Asst. Surg., Va. Vols., 932 Park Ave., Richmond, Va.
1897	Carter, Edward Champe,	Maj. and Surg., U. S. A., 1814 G St., Washington, D. C.
1893	Cassidy, Patrick,	Ex-Brig.-Gen. and Surg.-Gen., N. G., Conn., Norwich, Conn.
1896	Castle, Charles Henry,	Capt. and Asst. Surg., O. N. G., 215 W. 9th St., Cincinnati, O.
1891	Chandler, Ralph, *Cor. Sec., 1891-93.*	Capt. and Asst. Surg., Wis. N. G., 13 Grand Ave., Milwaukee, Wis.
1892	Clark, Thomas Chalmers,	Maj. and Surg., N. G., Minn., Stillwater, Minn.
1897	Clarke, Joseph Taylor,	Capt. and Asst. Surg., U. S. A., Care War Dept., Washington, D. C.
1898	Cogswell, William,	Maj. and Surg., M. V. M., 241 Boylston St., Boston, Mass.
1900	Colby, Charles DeWitt,	Capt. and Asst. Surg., Mich. N. G., Albion, Mich.
1893	Cole, Charles M.,	1st Lt. and Asst. Surg., R. I. M., 250 Broadway, Newport, R. I.
1895	Cook, Charles P.,	Col. and Asst. Surg.-Gen., N. G., N. Y., 243 Warren St., Hudson, N. Y.
1898	Cook, Frank Clarendon,	P. A. Surg. (Lt. j. g.), U. S. N., Washington, D. C.
1893	Cook, George,	Brig.-Gen. and Surg.-Gen. (Ret.), N. G., N. H., 16 Centre St., Concord, N. H.
1899	Coon, George M.,	Lt. and Asst. Surg., N. G., Minn,. 110 Lowry Arcade, St. Paul, Minn.
1894	Corwin, Richard Warren,	Col. and Asst. Surg. Gen., N. G., Colo., Pueblo, Colo.
1895	Cowell, George B.,	1st Lt. and Asst. Surg., N. G., Conn., 120 E. Washington Ave., Bridgeport, Conn.

Elected.		
1895	Crandall, Rand Percy,	P. A. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1894	Crispel, Charles Winegar,	1st Lt. and Asst. Surg., N. G., N. Y., Rondout, N. Y.
1897	Crooker, George Hazard,	Ex-Capt. and Asst. Surg., R. I. M., 159½ Benefit St., Providence, R. I.
1894	Currier, Edward Hervey,	Lt.-Col. and Med. Dir., N. H. N. G., 782 Elm St., Manchester, N. H.
1898	Czibulka, Alfons Clemens,	1st Lt. and Asst. Surg., I. N. G., Warren, Ill.
1898	Daly, William H.,	Maj. and Chief Surg., U. S. V., 516 Market St., Pittsburg, Pa.
1895	Dawson, Lewis Reeves,	Lt.-Col. and Brig. Surg., N. G., Wash., Box 249, Seattle, Wash.
1895	Day, Frank Leslie,	Maj. and Surg., R. I. M., 240 Benefit St., Providence, R. I.
1894	Dearing, Howard Sumner,	Maj. and Surg., M. V. M., 607 Tremont St., Boston, Mass.
1898	de Forest, Henry Pelouze,	Maj. and Surg., N. G., N. Y., 369 Hancock St., Brooklyn, N. Y.
1891	de Niedman, Wladimir Feodor,	Maj. and Surg., N. G., Kan., Lachta Place, Pittsburg, Kan.
1895	Derr, Ezra Z.,	Surg. (Lt.), U. S. N., Portsmouth, N. H.
1894	Devine, William H.,	Lt.-Col. and Med. Dir., M. V. M., 595 Broadway, So. Boston, Mass.
1897	Dickerson, John Henry,	Capt. and Asst. Surg., O. N. G., 225 N. Champion Ave., Columbus, O.
1897	Dickson, Samuel Henry,	Surg. (Lt.), U. S. N., Care Navy Dept., Washington, D. C.
1899	Dillenbeck, F. E.,	Capt. and Asst. Surg., N. G., Kan., El Dorado, Kan.
1895	Dixon, Charles Henry,	Maj. and Surg., N. G., Mo., 3345 Morgan St., St. Louis, Mo.
1898	Dougherty, Arthur C.,	2d Lt. and Asst. Surg., N. G., N. J., 158 Washington St., Newark, N. J.
1900	Drumheller, Francis E.,	Lt. and Asst. Surg., N. G., Pa., Sunbury, Pa.
1893	Dutton, Charles Elvan,	1st Lt. and Asst. Surg., N. G., Minn., 602 Nicollet Ave., Minneapolis, Minn.
1893	Eagleson, James Beaty,	Col. and Surg.-Gen., N. G., Wash., 512 Burke Bldg., Seattle, Wash.
1894	Edie, Guy L.,	Capt. and Asst. Surg., U. S. A., Care War Dept., Washington, D. C.
1891	Edwards, John B.,	Brig.-Gen. and Surg.-Gen., Wis., N. G., Mauston, Wis.
1900	Elliott, Gilbert M.,	1st Lt. and Asst. Surg., N. G., Me., Brunswick, Me.
1895	Emmerling, Karl A.,	1st Lt. and Asst. Surg., N. G., Pa., Pittsburg, Pa.
1895	Erwin, James J., *Treasurer, 1896-98.*	Capt. and Asst. Surg., O. N. G., 1617 Cedar Ave., Cleveland, O.
1891	Evans, Theodore W.,	Maj. and Surg., Wis. N. G., 3 Pinckney St., Madison, Wis.

ELECTED.		
1897	Fales, Warren Dexter,	Lt. and Asst. Surg., Cmdg. Amb. Corps, N. G., D. C. 915 L St. N. W., Washington, D. C.
1898	Farenholt, Ammen,	P. A. Surg. (Lt. j. g.), U. S. N., Care Surg.-Gen., U. S. N., Washington, D. C.
1896	Farrell, P. J. H.,	Capt. and Asst. Surg., N. G., Cal., 92 State St., Chicago, Ill.
1891	Festorazzi, Angelo,	Ex-1st Lt. and Asst. Surg., S. T., Ala., 153 Government St., Mobile, Ala.
1897	Fish, Earl Hamilton,	1st Lt. and Asst. Surg., N. G., Colo., 2535 Champa St., Denver, Colo.
1892	Fitz Gerald, Reynaldo Juan,	Lt.-Col. and Med. Dir., N. G., Minn., 128 Fifth St. So., Minneapolis, Minn.
1897	Flagg ,Charles Edward Belin,	Capt. and Asst. Surg., U. S. A., Care Surg.-Gen., Washington, D. C.
1893	Forwood, William Henry,	Col. and Asst. Surg.-Gen., U. S. A., San Francisco, Cal.
1894	Foster, Charles Chauncey, *Editor, 1896-97.*	Maj. and Surg., M. V. M., 8 Elmwood Ave., Cambridge, Mass.
1892	Foster, Romulus Adams,	1st Lt. and Asst. Surg., N. G., D. C., 2029 Q St. N. W., Washington, D. C.
1893	Fowler, George Ryerson,	Maj. and Surg., N. G., N. Y., 301 DeKalb Ave., Brooklyn, N. Y.
1896	Frazier, Charles Harrison,	1st Lt. and Asst. Surg., N. G., Pa., 133 So. 18th St., Philadelphia, Pa.
1893	French, Charles Henry,	Lt.-Col. and Med. Dir., R. I. M., 109 Broadway, Pawtucket, R. I.
1897	Frick, Euclid Bernardo,	Capt. and Asst. Surg., U. S. A., Fort Wadsworth, N. Y.
1897	Fryer, Blencowe E.,	Lt.-Col. and Dep. Surg.-Gen. (Ret.), U. S. A., 520 E. 9th St., Kansas City, Mo.
1891	Fuller, Charles Gordon,	Maj. and Surg., I. N. G., 100 State St., Chicago, Ill.
1895	Gandy, Charles Moore,	Capt. and Asst. Surg., U. S. A., Fort Slocum, N. Y.
1894	Gardner, Edwin Fisher,	Maj. and Surg., U. S. A., Fort Grant, Ariz.
1895	Gates, Manley Fitch,	P. A. Surg. (Lt. j. g.), U. S. N., Naval Hospital, Norfolk, Va.
1897	Gibson, Robert Jackson,	Maj. and Surg., U. S. A., San Francisco, Cal.
1898	Gilham, Cuthbert,	Maj. and Surg., W. Va. N. G., Anstead, W. Va.
1893	Girard, Alfred C.,	Maj. and Surg., U. S. A., San Francisco, Cal.
1894	Glennan, James D.,	Capt. and Asst. Surg., U. S. A., Care Surg. Gen., Washington, D. C.
1896	Glover, Lawrence Ritchfield,	Ensign and Asst. Surg., N. R., N. J., Haddonfield, N. J.
1892	Godfrey, Charles Cartlidge,	Ex-Maj. and Surg., N. G., Conn., 242 State St., Bridgeport, Conn.

ELECTED.		
1892	Godfrey, E. L. B.,	Col. and Asst. Surg. Gen., N. G., N. J., 400 Linden St., Camden, N. J.
1894	Godfrey, Guy Charles Moore,	Capt. and Asst. Surg., U. S. A., Pinar del Rio, Cuba.
1899	Goodrich, Asa F.,	Lt. and Asst. Surg., N. G., Minn., Germania Bldg., St. Paul, Minn.
1897	Gotwald, David King,	Capt. and Asst. Surg., O. N. G., Springfield, O.
1891	Grannis, Edward H.,	Maj. and Surg., Wis. N. G., Menominee, Wis.
1894	Grant, Thomas Page,	Capt. and Asst. Surg. (Ret.), K. S. G., 815 Third Ave., Louisville, Ky.
1899	Grant, William West,	Col. and Surg. Gen., N. G. Col., Denver, Colo.
1894	Green, Charles Montraville,	Maj. and Surg., M. V. M., 78 Marlborough St., Boston, Mass.
1896	Greene, Francis V.,	P. A. Surg. (Lt.) (Ret.), U. S. N., 33 So. 19th St., Philadelphia, Pa.
1891	Griffith, Jefferson D., *President, 1897-99.*	Lt. Col. and Med. Dir., N. G., Mo., 9th and Grand Ave., Kansas City, Mo.
1898	Grunwell, Alfred Gilbert,	Asst. Surg., U. S. N., Care Navy Dept., Washington, D. C.
1897	Guerin, Lovett T.,	Maj. and Surg., O. N. G., 578 N. High St., Columbus, O.
1897	Gunsaulus, Fred.,	Capt. and Asst. Surg., O. N. G., 29 W. Long St., Columbus, O.
1897	Guest, Middleton Semmes,	P. A. Surg (Lt. j. g.), U. S. N., Naval Hospital, Philadelphia, Pa.
1896	Guthrie, Joseph Alfred,	P. A. Surg (Lt. j. g.), U. S. N., Navy Yard, Norfolk, Va.
1892	Hake, William F.,	Maj. and Surg., M. S. T., 47 E. Bridge St., Grand Rapids, Mich.
1892	Halberstadt, George Howell,	Maj. and Surg., N. G. Pa., 218 Market St., Pottsville, Pa.
1891	Halley, George,	Maj. and Surg., N. G., Mo., 438 New Ridge Bldg., Kansas City, Mo.
1898	Hammond, Josiah Shaw,	Maj. and Surg., N. G., Mont., Butte, Mont.
1896	Hanson, G. F.,	Lt. Col. and Med. Dir., N. G., Cal., 3534 Mission St., San Francisco, Cal.
1899	Harrelson, Nathan O.,	Maj. and Surg., U. S. V., 517 Rialto Bldg., Kansas City, Mo.
1895	Harris, Henry Sutton Tarring,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1894	Harvey, Norman Darrell,	Maj. and Surg., R. I. M., 260 Benefit St., Providence, R. I.
1894	Harvey, Philip Francis, *Editor, 1895-96.*	Maj. and Surg., U. S. A., Presidio, San Francisco, Cal.
1893	Havard, Valery,	Maj. and Surg., U. S. A., Santiago, Cuba.
1898	Hayes, Robert G. H.,	Lt. and Asst. Surg., U. S. V., 11 Spring St., Bellefonte, Pa.
1896	Heizmann, Charles Lawrence,	Maj. and Surg., U. S. A., San Antonio, Tex.

ELECTED.		
1892	Hendley, Frank W.,	Maj. and Surg., O. N. G., 785 E. McMillan St., Cincinnati, O.
1891	Henry, Nelson H., *First Vice-Pres., 1891-93.*	Col. and Asst. Surg. Gen., N. G., N. Y., 14 E. 10th St., New York, N. Y.
1896	Hersey, Freeman Clark,	Lt. Col. and Med. Dir., M. V. M., 96 Huntington Ave., Boston, Mass.
1897	Hobbs, Wilbert A.,	Capt. and Asst. Surg., O. N. G., East Liverpool, O.
1891	Hoff, John Van Rensselaer, *First Vice-Pres., 1897-98,* *Second Vice-Pres., 1896-97.*	Maj. and Surg., U. S. A., Washington, D. C.
1896	Hoffman, John Raymond,	Capt. and Asst. Surg., I. N. G., 63 Wabash Ave., Chicago, Ill.
1893	Hooper, Henry,	Ex-Capt. and Asst. Surg., I. N. G., 541 N. State St., Chicago, Ill.
1896	Hopkins, William Evelyn,	Col. and Surg. Gen., N. G., Cal., 803 Sutter St., San Francisco, Cal.
1892	Hough, Charles Pinckney,	Ex-Brig. Gen. and Surg. Gen., N. G., Mont., 415 Atlas Blk., Salt Lake City, Utah.
1895	Howard, Deane Childs,	Capt. and Asst. Surg., U. S. A., Fort Hancock, N. J.
1897	Huddleston, John Henry,	Capt. and Asst. Surg., N. G., N. Y., 126 W. 85th St., New York, N. Y.
1899	Huidekoper, Rush Shippen,	Lt. Col. and Chief Surg., U. S. V., Army and Navy Club, 16 W. 31st St., New York, N. Y.
1899	Hutchings, R. K.,	Lt. and Asst. Surg., N. G., Colo., Colorado Springs, Colo.
1896	Hyde, James Nevins,	Lt. N. R., Ill., Ex-P. A. Surg., U. S. N., 100 State St., Chicago, Ill.
1900	Iglehart, James Davidson,	Capt. and Asst. Surg., N. G., Md., 211 W. Lanvale St., Baltimore, Md.
1894	Ives, Francis Joseph,	Capt. and Asst. Surg., U. S. A., Matanzas, Cuba.
1894	Izlar, Roberts P.,	1st Lt. and Surg., S. T., Fla., Waycross, Ga.
1899	Jackson, Charles Warren,	Lt. and Asst. Surg., N. G., N. Y., 130 W. 81st St., New York, N. Y.
1894	Jackson, Jabez North,	Capt. and Asst. Surg., N. G., Mo., 413 Rialto Bldg., Kansas City, Mo.
1892	Jarrett, Arthur R.,	Capt. and Asst. Surg., N. G., N. Y., 95 Halsey St., Brooklyn, N. Y.
1895	Jarvis, Nathan Sturges,	Lt. Col. and Asst. Surg. Gen., N. G., N. Y., Ex-Capt. and Asst. Surg., U. S. A., 142 Madison Ave., New York, N. Y.
1897	Jenne, James N.,	Brig. Gen. and Surg. Gen., Vt., 130 Main St., St. Albans, Vt.
1894	Johnston, James,	Maj. and Surg., N. G., Pa., Bradford, Pa.
1895	Johnston, William McCandless,	Maj. and Surg., N. G., Pa., Sewickly, Pa.
1899	Jones, George H.,	Lt. and Asst. Surg., 10th O. V. I., 2304 Franklin Ave., Toledo, O.

ELECTED.		
1897	Jordan, Charles Simonton,	Capt. and Asst. Surg., S. G., N. C., Asheville, N. C.
1892	Kaufman, Franklin John,	1st Lt. and Asst. Surg., N. G., N. Y., 311 W. Genesee St., Syracuse, N. Y.
1896	Kean, Jefferson Randolph,	Capt. and Asst. Surg., U. S. A., Quemados, Cuba.
1899	Keller, J. M.,	Col. and Surg. Gen,, Ark. N. G., Hot Springs, Ark.
1897	Kemble, Lewis Hasbrouck,	Maj. and Surg., N. G., Colo., Aspen, Colo.
1898	Kemp, Franklin M.,	1st Lt. and Asst. Surg., U. S. A., West Point, N. Y.
1898	Kendall, Francis Drake,	Maj. and Surg., S. C. V. T., 1309 Plain St., Columbia, S. C.
1897	Kendall, William Pratt,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1897	Kennedy, Robert Morris,	P. A. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1895	Kenyon, George Henry,	Brig. Gen. and Surg. Gen., R. I. M., 123 N. Main St., Providence, R. I.
1895	Kilbourne, Henry Sales,	Maj. and Surg., U. S. A., Army Bldg., New York, N. Y.
1895	Kimball, James P.,	Maj. and Surg., U. S. A., Fort Columbus, New York, N. Y.
1898	Kingston, Robert J.,	1st Lt. and Asst. Surg., N. G., N. Y., 185 Grand St., Newburgh, N. Y.
1895	Kneedler, William L.,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1896	Kulp, John Stewart,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1896	Kuyk, Dirk Adrian,	Maj. and Surg., Va. V., 4 W. Grace St., Richmond, Va.
1891	La Garde, Louis A.,	Maj. and Surg., U. S. A., Soldier's Home, Washington, D. C.
1893	La Pierre, Julian,	Maj. and Surg., N. G., Conn., 220 Central Ave., Norwich, Conn.
1896	Leach, Philip,	Surg. (Lt.), U. S. N., Surgeon Asiatic Station, Care Navy Dept., Washington, D. C.
1898	Ledeboer, Francois S.,	1st Lt. and Asst. Surg., N. G., S. D., Spearfish, So. Dak.
1895	Lee, Edward Wallace,	Col. and Surg. Gen., N. G., Neb., 315 So. 15th St., Omaha, Neb.
1893	Lee, Simeon Lemuel,	Col. and Surg. Gen., Nev., Carson, Nev.
1894	Lippincott, Henry,	Lt. Col. and Dep. Surg. Gen., U. S. A., Denver, Colo.
1898	Lippitt, William Fontaine,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1891	Little, Frederick H.,	Brig. Gen. and Surg. Gen. (Ret.), N. G., Ia., 116 W. 2d St., Muscatine, Ia.
1897	Lowes, Joseph E.,	Brig. Gen. and Surg. Gen., Ohio, Dayton, O.

ELECTED.		
1896	Lowndes, Charles Henry Tilghman,	P. A. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1900	Mac Evitt, John Cowell,	Lt. and Surg., N. M., N. Y., 407 Clinton St., Brooklyn, N. Y.
1895	McCandless, Alexander A. E.,	Lt. Col. and Surg. in Chief, N. G., Pa., Pittsburg, Pa.
1895	McCarthy, William Daniel,	Maj. and Surg., N. G., Cal., 111 Eddy St., San Francisco, Cal.
1894	McCaw, William J.,	Maj. and Surg., R. I. M., 222 Benefit St., Providence, R. I.
1900	McClintic, Thomas Brown,	Asst. Surg., U. S. M.-H. S., Southport, N. C.
1899	McComb, J. Baldwin,	Capt. and Asst. Surg., O. N. G., 217 E. State St., Columbus, O.
1898	McCord, Thomas Chester,	Maj. and Surg., 4th Ill. Inf., U. S. V., Paris, Ill.
1894	McDill John R.,	Capt. and Asst. Surg., Wis. N. G., 200 Wisconsin St., Milwaukee, Wis.
1900	Mahoney, George William,	Capt. and Asst. Surg., I. N. G., 100 State St., Chicago, Ill.
1891	Mann, Alban L.,	Maj. and Surg. (Ret.), I. N. G., 214 Chicago St., Elgin, Ill.
1891	Marion, Otis H.,	Lt. Col. and Med. Dir., M. V. M., 22 Harvard Ave., Allston Station, Boston, Mass.
1894	Marmion, Robert Augustine,	Med. Dir. (Capt.), U. S. N., Naval Hospital, Philadelphia, Pa.
1895	Marsh, William H.,	Act. Asst. Surg., U. S. M.-H. S., Solomons, Md.
1893	Martin, Edward,	Maj. and Surg., N. G., Pa., 415 So. 15th St., Philadelphia, Pa.
1894	Mason, Charles Field,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1895	Maus, Louis Mervin,	Maj. and Surg., U. S. A., Manila, P. I.
1898	Maybury, William Jordan,	Col. and Surg. Gen. of Maine, Saco, Me.
1897	Mayer, Daniel,	Brig. Gen. and Surg. Gen., W. Va., Charleston, W. Va.
1895	Mead, Harry,	Capt. and Asst. Surg., N. G., N. Y., 758 Elmwood Ave., Buffalo, N. Y.
1895	Meyer, Robert C. J.,	Asst. Surg. (Ensign), Ill. N. R., Moline, Ill.
1895	Middleton, Johnson Van Dyke,	Lt. Col. and Dep. Surg. Gen. (Ret.), U. S. A., Occidental Hotel, San Francisco, Cal.
1900	Milligan, Samuel Cargill,	Maj. and Surg., N. G., Pa., 609 Smith Block, Pittsburg, Pa.
1900	Miner, Charles H.,	Asst. Surg., N. G., Pa., Wilkesbarre, Pa.
1900	Montelius, Ralph W.,	Maj. and Surg., N. G., Pa., Mt. Carmel, Pa.
1895	Moore, Henry McI. W.,	Lt. Col. and Chief Surg., O. N. G., 656 E. Long St., Columbus, O.

ELECTED.		
1900	Moore, John Miller,	Lt. and P. A. Surg., U. S. N., Washington, D. C.
1895	Morris, Lewis,	P. A. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1898	Morris, Lewis Coleman,	Capt. and Asst. Surg., Ala. N. G., Chalifaux Bldg., Birmingham, Ala.
1898	Morse, William E. H.,	Capt. and Asst. Surg., N. G., Ia., Algona, Kossuth Co., Ia.
1900	Munson, Edward Lyman,	Capt. and Asst. Surg., U. S. A., Washington Barracks, Washington, D. C.
1894	Murray, Robert Drake,	Surg., U. S. M.-H. S., Key West, Fla.
1891	Myers, Charles F. W.,	Lt. Col. and Med. Dir., N. G., N. J., 108 Broadway, Paterson, N. J.
1894	Newgarden, George J.,	Capt. and Asst. Surg., U. S. A., Fort McHenry, Md.
1896	Norton, Oliver Dwight,	Surg. (Lt.), U. S. N., Care Navy Dept., Washington, D. C.
1892	O'Neill, James Wilks,	Maj. and Surg., N. G. Pa. (Ret.), 2110 Spruce St., Philadelphia, Pa.
1897	Osborn, Arthur Leland,	Maj. and Surg., O. N. G., Norwalk, O.
1892	Owen, William Otway,	Capt. and Asst. Surg., U. S. A., Fort Thomas, Ky.
1895	Parkhill, Clayton,	Col. and Surg. Gen. (Ret.), N. G., Colo., McPhee Bldg., Denver, Colo.
1896	Peck, George,	Med. Dir. (Capt.), (Ret.), U. S. N., 926 N. Broad St., Elizabeth, N. J.
1900	Peck, O. W.,	Surgeon General, Vt., Winooski, Vt.
1897	Peckham, Charles F.,	Lt. and Surg., N. B. R. I., 176 Benefit St., Providence, R. I.
1892	Peckham, Cyrus T.,	Surgeon, U. S. M.-H. S., Galveston, Tex.
1897	Penrose, George H.,	Col. and Surg. Gen., N. G., Utah, Salt Lake City, Utah.
1895	Percy, Henry Tucker,	Surg. (Lt.), U. S. N., Navy Yard, Norfolk, Va.
1894	Perley, Henry Otis,	Maj. and Surg., U. S. A., Manila, P. I.
1896	Persons, Remus Charles,	Med. Insp. (Comdr.), U. S. N., Care Navy Dept., Washington, D. C.
1897	Pesold, Carl,	Capt. and Asst. Surg., N. G., Mo., 1502 Wagoner Pl., St. Louis, Mo.
1900	Peters, Jacob Mark,	1st Lt. and Asst. Surg., N. G., Pa., Steelton, Pa.
1896	Pettigrew, George Atwood,	Col. and Surg. Gen., N. G., So. Dak., Flandreau, So. Dak.
1897	Phillips, Albert William,	Brig. Gen. and Surg. Gen. (Ret.), N. G., Conn., Derby, Conn.
1895	Phillips, Frank I.,	Act. Asst. Surg., U. S. M.-H. S., Escanaba, Mich.

ELECTED.		
1894	Phillips, John Leighton,	Capt .and Asst. Surg., U. S. A., 73 Hanover St., Boston, Mass.
1900	Pleadwell, Frank Lester,	Asst. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1895	Poindexter, Jefferson Dudley,	Capt. and Asst. Surg., U. S. A., Ft. Reno, Okla.
1897	Pope, Benjamin Franklin,	Lt. Col. and Dep. Surg. Gen., U. S. A., San Francisco, Cal.
1894	Porter, Joseph Y.,	Maj. and Surg., S. T., Fla., Jacksonville, Fla.
1900	Potteiger, George Frederick,	1st Lt. and Asst. Surg., N. G., Pa., Hamburg, Pa.
1894	Powell, Junius Levert,	Maj. and Surg., U. S. A., Manila, P. I.
1899	Powell, Seneca Daniel,	Maj. and Brig. Surg., N. G., N. Y., 12 W. 40th St., New York, N. Y.
1894	Priestley, James Taggart,	Brig. Gen. and Surg. Gen., Ia., 707 E. Locust St., Des Moines, Ia.
1892	Pritchett, Gilbert L.,	Maj. and Surg., N. G., Neb., Fairbury, Neb.
1895	Purviance, W. E.,	Capt. and Asst. Surg., U. S. A., Vancouver Barracks, Wash.
1900	Ralston, B. Stewart,	1st Lt. and Asst. Surg., N. G., Pa., Penn Ave. and Main St., Pittsburg, Pa.
1897	Rannels, David A.,	Capt. and Asst. Surg., O. N. G., McArthur, O.
1900	Raymond, Henry I.,	Maj. and Surg., U. S. A., Pullman Bldg., Chicago, Ill.
1898	Reed, Robert Harvey,	Col. and Surg. Gen. of Wyo., Rock Springs, Wyo.
1894	Reed, Walter,	Maj. and Surg., U. S. A., Surg. Genl's Office, Washington, D. C.
1894	Reynolds, Frederick P.,	Capt. and Asst. Surg., U. S. A., Manila, P. I.
1898	Rhoads, Thomas Leidy,	Asst. Surg., U. S. N., Boyerstown, Pa.
1899	Richard, Charles,	Maj. and Surg., U. S. A., Fort Leavenworth, Kan.
1896	Richards, Theodore W.,	P. A. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1900	Richings, Henry,	Maj. and Surg., I. N. G., Rockford, Ill.
1895	Richardson, William Lambert,	Lt. Col. and Surg., M. V. M., 225 Commonwealth Ave., Boston, Mass.
1897	Rieg, Philip S.,	Ensign and Asst. Surg., N. B., O. N. G., 338 Summit St., Toledo, O.
1900	Ritchie, Harry Parks,	1st Lt. and Asst. Surg., N. G., Minn., St. Paul, Minn.
1896	Ritter, F. Horace S.,	1st Lt. and Asst. Surg., N. G., N. Y., 314 E. Church St., Elmira, N. Y.
1895	Rixey, Presley Marion,	Surg. (Lt.), U. S. N., Naval Dispensary, Washington, D. C.
1898	Roberts, Thomas Elmer,	Capt. and Asst. Surg., I. N. G., 144 So. Oak Park Ave., Oak Park, Ill.

Elected.		
1891	Robertson, Charles Moore,	Maj. and Surg., N. G., Ia., Davenport, Ia.
1893	Robbins, Robert Patterson,	1st Lt. and Asst. Surg., N. G., Pa., 2110 Pine St., Philadelphia, Pa.
1896	Rockwell, Thomas F.,	Maj. and Surg., N. G., Conn., Rockville, Conn.
1894	Rolfe, William Alfred,	1st Lt. and Asst. Surg., M. V. M., 249 W. Newton St., Boston, Mass.
1900	Rothert, William Henry,	Capt. and Asst. Surg., O. N. G., 1632 Freeman St., Cincinnati, O.
1900	Rowe, Jesse,	Capt. and Asst. Surg., I. N. G., Abingdon, Ill.
1900	Runnels, Orange S.,	Col. and Surg. Gen., Ind. N. G., Indianapolis, Ind.
1895	Sawtelle, Henry W.,	Surg., U. S. M.-H. S., Chicago, Ill.
1894	Schuyler, Clarkson C.,	1st Lt. and Asst. Surg. (Ret.), N. G., N. Y., Box 212, Plattsburg, N. Y.
1894	Scofield, Walter Keeler,	Med. Dir. (Capt.), U. S. N., Philadelphia, Pa.
1900	Senn, William Nicholas,	1st Lt. and Asst. Surg., I. N. G., 532 Dearborn Ave., Chicago, Ill.
1893	Sevey, Harry Sheldon,	Capt. and Asst. Surg. (Ret.), N. G., S. D., Arizpe, Sonora, Mexico.
1894	Shannon, William C.,	Maj. and Surg. (Ret.), U. S. A., Phœnix, Ariz.
1894	Shaw, John Bliss,	Maj. and Surg., I. N. G., Joliet, Ill.
1896	Shipp, Edward Mansfield,	P. A. Surg. (Lt. j. g.), U. S. N., Naval Hospital, Norfolk, Va.
1899	Shoemaker, John Veitch,	Col. and Surg. Gen., Pa., 1519 Walnut St., Philadelphia, Pa.
1892	Silliman, James E.,	Maj. and Surg., N. G., Pa., 137 W. 8th St., Erie, Pa.
1896	Simpson, James Edwin,	Maj. and Surg., M. V. M., 348 Essex St., Salem, Mass.
1897	Skene, William H.,	1st Lt. and Asst. Surg., N. G., N. Y., 143 Clinton St., Brooklyn, N. Y.
1894	Skinner, John O.,	Maj. and Surg. (Ret.), U. S. A., Chambersburg, Pa.
1893	Smart, Charles,	Lt. Col. and Dep. Surg. Gen., U. S. A., 2017 Hillyer Pl., Washington, D. C.
1895	Smith, Allen V.,	Capt. and Asst. Surg., O. N. G., Canton, O.
1895	Smith, French W.,	1st Lt. and Asst. Surg., W. Va. N. G., Bluefield, W. Va.
1895	Smith, George Tucker,	P. A. Surg. (Lt. j. g.), U. S. N., Naval Laboratory, Brooklyn, N. Y.
1898	Smith, R. K.,	P. A. Surg (Lt. j. g.), U. S. N., Navy Yard, Mare Island, San Francisco, Cal.
1893	Smith, William Lloyd,	Maj. and Surg., I. N. G., 306 S. Park St., Streator, Ill.

ELECTED.		
1900	Spence, Thos. Bray,	Capt. and Asst. Surg., N. G., N. Y., 139 7th Ave., Brooklyn, N. Y.
1897	Srodes, J. Lewis,	1st Lt. and Asst. Surg., N. G., Pa., 742 Penn Ave., Wilkinsburg, Pa.
1893	Standish, Myles,	Capt. Com. Amb. Corps, M. V. M., 6 St. James Ave, Boston, Mass.
1898	Stanton, Samuel Cecil, *Asst. Secretary 1899-01.*	1st Lt. and Asst. Surg., I. N. G., 9 Cedar St., Chicago, Ill.
1897	Stark, William T.,	Capt. and Asst. Surg., N. G., Mo., Kansas City, Mo.
1894	Stayer, Andrew Snowberger,	Maj. and Surg., N. G., Pa., 1501 7th Ave., Altoona, Pa.
1898	Stedman, Joseph Cyrus,	2d Lt. Amb. Corps, M. V. M., 116 Sedgwick St., Boston, Mass.
1897	Stephenson, Franklin Bache,	Surg. (Lt.), U. S. N., Care Navy Dept., Washington, D. C.
1897	Stephenson, William,	Capt. and Asst. Surg., U. S. A., Army Bldg., New York, N. Y.
1893	Sternberg, George Miller, *President 1894-95.*	Brig. Gen. and Surg. Gen., U. S. A., Washington, D. C.
1898	Stewart, Edward Larkin,	1st Lt. and Asst. Surg., F. S. T., Starke, Fla.
1895	Stewart, Walter Scott,	1st Lt. and Asst. Surg., N. G., Pa., 52 So. Franklin St., Wilkesbarre, Pa.
1894	Stiles, Henry Ranney,	Capt. and Asst. Surg., U. S. A., Madison Barracks, N. Y.
1896	Stitt, Edward R.,	P. A. Surg (Lt.), U. S. N., Care Navy Dept., Washington, D. C.
1899	Stone, Alexander J.,	Brig. Gen., Surg. Gen., N. G., Minn., Lowry Arcade, St. Paul, Minn.
1900	Stoner, George W.,	Surg. U. S. M.-H. S., Stapleton, S. I., New York.
1899	Stover, Bruce H.,	Lt. and Asst. Surg., N. G., Ia., Carroll, Iowa.
1891	Streeter, John Williams,	Lt. Col. and Asst. Surg. Gen., I. N. G., 2646 Calumet Ave., Chicago, Ill.
1897	Stroud, Harrison Edward,	Col. and Surg. Gen., Ariz., Phœnix, Ariz.
1896	Sullivan, Thomas J.,	Maj. and Surg., I. N. G., 4709 Michigan Ave., Chicago, Ill.
1896	Taneyhill, G. Lane,	Maj. and Surg. (Ret.), N. G., Md., 1103 Madison Ave., Baltimore, Md.
1894	Taylor, Walter L.,	Ex-Capt. and Asst. Surg., O. N. G., 933 Grand Ave., Cincinnati, O.
1892	Terriberry, George W.,	Col. and Div. Surg., N. G., N. J., 146 Broadway, Paterson, N. J.
1895	Terry, Marshall Orlando,	Brig. Gen. and Surg. Gen., N. G., N. Y., 196 Genesee St., Utica, N. Y.
1895	Tesson, Louis S.,	Maj. and Surg., U. S. A., Fort Ethan Allen, Vt.
1893	Thayer, Frederick C.,	Col. and Surg. Gen., Me. V. M., 119 Maine St., Waterville, Me.
1893	Thomson, Archibald G.,	1st Lt. and Asst. Surg., N. G., Pa., 1426 Walnut St., Philadelphia, Pa.

ELECTED.		
1900	Thomson, Hiram Benson,	Maj. and Surg., N. G., Conn., New London, Conn.
1899	Torney, George H.,	Maj. and Surg., U. S. A., Army and Navy Genl. Hosp., Hot Springs, Ark.
1899	Townsend, Joseph Hendley,	Maj. and Surg., Conn. N. G., 39 College St., New Haven, Conn.
1900	Trecartin, David Munson,	Ens. and Asst. Surg., N. B., N. G., Conn., 352 State St., Bridgeport, Conn.
1894	Tuholske, Herman,	Maj. and Surg., N. G., Mo., 410 N. Jefferson St., St. Louis, Mo.
1893	Turnbull, Charles Smith,	Maj. and Surg., N. G., Pa., 1935 Chestnut St., Philadelphia, Pa.
1896	Turner, William D.,	Maj. and Surg., Va. V., Fergusson's Wharf, Va.
1895	Tuttle, Jay,	Act. Asst. Surg., U. S. M.-H. S., Astoria, Ore.
1894	Twitchell, Herbert Eugene,	Capt. and Asst. Surg., O. N. G., 24 So. B St., Hamilton, O.
1896	Vaughan, Bolivar Alvearr,	Lt. Col. and Asst. Surg. Gen., Miss. N. G., Columbus, Miss.
1900	Vaughan, George Tully,	Surg. U. S. M.-H. S., 816 17th St., Washington, D. C.
1895	Wakeman, William James,	Capt. and Asst. Surg., U. S. A., Fort Thomas, Ky.
1894	Wallace, David L.,	Maj. and Surg., N. G., N. J., 192 Clinton Ave., Newark, N. J.
1896	Wallace, Henry,	Capt. and Asst. Surg., N. G., N. Y., 183 Congress St., Brooklyn, N. Y.
1899	Walls, Charles Bruce,	1st Lt. and Asst. Surg., I. N. G., 1003 Warren Ave., Chicago, Ill.
1900	Warbasse, James P.,	Capt. and Asst. Surg., N. G., N. Y., 68 Greene Ave., Brooklyn, N. Y.
1896	Ward, John M. Broomall,	1st Lt. and Asst. Surg., N. G., Pa., Quarantine Station, Marcus Hook, Pa.
1899	Ward, Milo Buel,	Maj. and Brig. Surg., U. S. V., Kansas City, Mo.
1897	Warfield, Ridgley Brown,	Brig. Gen. and Surg. Gen., Md., 214 W. Franklin St., Baltimore, Md.
1896	Waters, William E.,	Lt. Col. and Dep. Surg. Gen. (Ret.), U. S. A., Care Surg. Gen., U. S. A., Washington, D. C.
1893	Watson, Wilbur S.,	Lt. Col. and Med. Dir., N. G., Conn., 66 West St., Danbury, Conn.
1896	Weaver, Clarence A.,	Capt. and Surg., N. G., D. C., 1614 Q St. N. W., Washington, D. C.
1892	Weaver, Joseph K.,	Maj. and Surg., N. G., Pa., Norristown, Pa.
1893	Wertenbaker, Charles Poindexter,	P. A. Surg., U. S. M.-H. S., New Orleans, La.
1897	Westervelt, William Alfred, *Asst. Secy., 1897-98.*	Maj. and Surg., O. N. G., 62 E. Broad St., Columbus, O.

ELECTED.		
1891	Wheaton, Charles A.,	Brig. Gen. and Surg. Gen. (Ret.), Minn., 326 Wabasha St., St. Paul, Minn.
1897	Wheaton, James Lucas,	1st Lt. Hosp. Corps, R. I. M., Summer St., Pawtucket, R. I.
1899	Whitcomb, Edward H.,	Maj. and Asst. Surg. Gen., N. G., Minn., 199 E. 7th St., St. Paul, Minn.
1899	White, Wm. Seymour,	1st Lt. and Asst. Surg., I. N. G., 370 Warren Ave., Chicago, Ill.
1900	Whiting, Joe,	Maj. and Surg., Wis. N. G., Janesville, Wis.
1897	Wieber, Francis William Ferdinand,	Surg. (Lt.), U. S. N., San Juan, P. R.
1891	Wilkie, Frederick J.,	Maj. and Surg., Wis. N. G., 61 Merritt St., Oshkosh, Wis.
1897	Willard, William G.,	Maj. and Surg., I. N. G., 544 Washington Boul., Chicago, Ill.
1895	Willcox, Charles,	Capt. and Asst. Surg., U. S. A., Fort Sam Houston, Tex.
1897	Williams, John Hey,	Col. and Surg. Gen., N. C., 53 Haywood St., Asheville, N. C.
1897	Wilson, Charles E.,	Capt. and Asst. Surg., N. G., Mo., 906 Main St., Kansas City, Mo.
1898	Wilson, George B.,	P. A. Surg. (Lt. j. g.), U. S. N., Care Navy Dept., Washington, D. C.
1897	Wilson, James Sprigg,	1st Lt. and Asst. Surg., U. S. A., Manila, P. I.
1900	Wilson, William H.,	Capt. and Asst. Surg., U. S. A., Angel Island, San Francisco, Cal.
1891	Wilson, William W.,	Ex-Capt. and Asst. Surg, Ind. Inf. Legion, 620 3d St., Wausau, Wis.
1894	Wise, John Cropper, *Second Vice-Prest. 1897-98. First Vice-Prest. 1900-01.*	Med. Insp. (Comdr.), U. S. N., Care Navy Dept., Washington, D. C.
1896	Wood, Frederick John Jennings,	Maj. and Surg., N. G., N. Y., 199 De Kalb Ave., Brooklyn, N. Y.
1895	Wood, Marshall William,	Maj. and Surg., U. S. A., Jefferson Barracks, Mo.
1894	Woodhull, Alfred Alexander,	Lt. Col. and Dep. Surg. Gen., U. S. A., Manila, P. I.
1893	Woodruff, Charles Edward,	Capt. and Asst. Surg., U. S. A., Fort Riley, Kan.
1896	Woodruff, Ezra,	Maj. and Surg., U. S. A., Fort Hamilton, N. Y.
1896	Woods, George Worth,	Med. Dir. (Capt.), U. S. N., U. S. Naval Hospital, Brooklyn, N. Y.
1898	Wright, Arthur Lee,	Maj. and Surg., N. G., Ia., Carroll, Iowa.
1899	Wright, John William,	Lt. and Asst. Surg., N. G., Pa., 18 E. 8th St., Erie, Pa.
1897	Wright, S. B.,	Circleville, O.
1894	Wyeth, Marlborough Churchill,	Maj. and Surg., U. S. A., Havana, Cuba.
1896	Wylie, Winfred,	Col. and Surg. Gen., Ariz., Phœnix, Ariz.
1894	York, George William,	Maj. and Surg., N. G., N. Y., 190 Franklin St., Buffalo, N. Y.

ASSOCIATE MEMBERS.

Elected.		
1899	Adams, W. A.,	Late Lt. Col. and Med. Dir., Tex. V. G., Equitable Bldg., St. Louis, Mo.
1897	Asch, Morris J.,	Ex-Maj. and Surg., U. S. A., 5 W. 30th St., New York, N. Y.
1898	Board of Officers,	Sixty-Fifth Regt., N. G., N. Y., Buffalo, N. Y.
1900	Brooke, Benjamin,	Capt. and Asst. Surg. (Ret.), U. S. A., Radnor, Pa.
1897	Conner, Phineas S.,	Ex-Bvt. Maj. and Asst. Surg., U. S. A., 215 W. 9th St., Cincinnati, O.
1894	Donnelly, Richard A.,	Brig. Gen. and Q. M. Gen., N. J., Trenton, N. J.
1900	Geer, Edwin,	Lt. and Surg., N. R., Md., 1614 Bolton St., Baltimore, Md.
1900	Gettier, Harry Ernshaw,	Ex-Lt. and Act. Asst. Surg., U. S. A., Littlestown, Pa.
1900	Goetz, Wolfgang,	Maj. and Surg. (Ret.), N. G., N. Y., Altona, Hamburg, Germany.
1899	Grothan, Ole,	Late Maj. and Surg., 3d Neb. V. I., St. Paul, Neb.
1900	Haller, John Frederick,	1st Lt. and Asst. Surg. (Ret.), R. I. M., 623 Macon St., Brooklyn, N. Y.
1897	Hamilton, Charles S.,	Ex-Capt. and Asst. Surg., O. N. G., 142 E. Long St., Columbus, O.
1900	Hamilton, John,	1st Lt. and Asst. Surg. (Ret.), N. G., Ia., Cedar Rapids, Iowa.
1897	Hart, Hugh A.,	Ex-Brig. Gen. and Surg. Gen., O. N. G., Wooster, O.
1899	Hunter, Randall R.,	Late Maj. and Brig. Surg., U. S. V., Fulton, Kan.
1900	Lee, George Bolling,	Act. Asst. Surg., U. S. A., 215 W. 43d St., New York, N. Y.
1900	Le Seure, Oscar,	Late Maj. and Brig. Surg., U. S. V., 32 Adams St., Detroit, Mich.
1898	Liebich, Arthur K. A.,	Maj., 5th Infy., O. N. G., 80 Euclid Ave., Cleveland, O.
1897	Manley, Thomas H.,	Ex-Capt. and Asst. Surg., U. S. V., 115 W. 49th St., New York, N. Y.
1899	Martin, Frank H.,	1st Lt. and Asst. Surg., U. S. V., Topeka, Kan.
1892	Moore, Milton,	Brig. Gen. Comdg. 1st Brig., N. G., Mo., N. Y. Life Bldg., Kansas City Mo.
1896	Morris, Henry,	Ex-1st Lt. and Asst. Surg., N. G., Pa., 313 So. 16th St., Philadelphia, Pa.
1900	Murray, Frank W.,	Maj. and Surg. (Ret.), N. G., N. Y., 37 W. 39th St., New York, N. Y.
1896	Osgood, Frederick Huntington,	1st Lt. and Vet. Surg., M. V. M., 50 Village St., Boston, Mass.
1900	Robinson, John Franklin,	Maj. and Surg. (Ret.), N. G., N. H., The Kinnard, Manchester, N. H.

ELECTED.		
1894	Sander, Enno,	Ex-Maj., N. G., Mo., 129 So. 11th St., St. Louis, Mo.
1900	Seaman, Louis L.,	Late Maj. and Surg., U. S. V. E., 118 W. 31st St., New York, N. Y.
1899	Southard, Wm. Freeman,	Late Maj. and Surg., 2d Corps Mass. Cadets, 1220 Sutter St., San Francisco, Cal.
1894	Spencer, B. W.,	Brig.-Gen. and Insp.-Gen., N. G., N. J., Passaic, N. J.
1899	Trader, John W.,	Late Maj. and Surg., N. G., Mo., Sedalia, Mo.
1894	Truax, Charles,	44 Wabash Ave., Chicago, Ill.
1896	Van Pelt, Joseph K. T.,	Ex-Maj. and Brig. Surg., U. S. V., 1529 Spruce St., Philadelphia, Pa.
1896	Wagner, Clinton,	Ex-Bvt. Lt.-Col. and Surg., U. S. A., 19 E. 38th St., New York, N. Y.
1897	Whitaker, Hervey Williams,	Ex-P. A. Surg. (Lt.), U. S. N., 72 Grant Ave., Columbus, O.
1900	Wirt, William E.,	Lt.-Comdr., N. B., O. N. G., 477 Prospect St., Cleveland, O.
1896	Younger, William J.,	Ex-Col. and Med. Dir., N. G., Cal., 200 Stockton St., San Francisco, Cal.

CORRESPONDING MEMBERS.

ELECTED.		
1899	Sir W. Mitchell Banks, M. D., F. R. C. S.,	28 Rodney St., Liverpool, England.
1899	Surgeon Lt. Col. Fred W. Borden,	Minister of Militia and Defense for Canada, Ottawa, Canada.
1897	General Epifanio Cacho,	General Jefe del Cuerpo Medico Militar Mexicano (Surg.-Gen. Mexican Army), Ciudad Mexico, Mexico.
1897	Captain Hans Daal,	Sanitary Captain, Norwegian Army, Christiania, Norway.
1900	Major Narciso del Rio,	Cuerpo Medico Militar Mexicano, Vera Cruz, Mexico.
1892	Medicinalrad Edvard Martin Edholm,	Ofverfaltlakarne vid armeen (Surg.-Gen. Swedish Army), Stockholm, Sweden.
1897	Surgeon-Captain Rory Fletcher,	Surgeon-Captain, Central London Rangers, Groome, Streatham Park, London, S. W., Eng.
1892	General Thien Ho,	Medical Inspector General Siamese Army, Bangkok, Siam.
1897	Docent Dr. Otokar Kukula,	K. K. Assistenzarzt (Asst. Surg., Austro-Hungarian Army), Prague, Austro-Hungary.
1897	Coronel Fernando Lopez,	Coronel Medico Ciruj., Director Hosp. de Mexico (Col. and Dir. Hosp. of Instruction, Mexican Army), Ciudad Mexico, Mexico.

ELECTED.		
1899	Surgeon-Colonel William McWatters, R. A. M. C.,	Halifax, Nova Scotia.
1899	Lt. Col. Zacarias R. Molina,	Surgeon in Charge, Military Hospital, Vera Cruz, Mexico.
1900	Surg. Lt. Col. J. L. Hubert Neilson,	Dir.-Gen., Medical Department, Canadian Militia, Ottawa, Canada.
1896	Professor Nicolaysen,	University of Norway, Christiania, Norway.
1897	General William Silver Oliver,	Deputy Surg.-Gen., British Army Medical Department, 127 South Park St., Halifax, N. S.
1892	Sir J. O'Neil, C. B.,	Surg.-Gen. (Ret.), Indian Medical Service, London, England.
1892	Dr. Adolph Alexandrovitch Remert,	Inspecteur Général de Service de Santé Militaire, Inginernaia and Bolchaia Sadovaia Streets, St. Petersburg, Russia.
1899	Dr. Karl Rudberg,	Staff Surg., Swedish Navy, Stockholm, Sweden.
1892	Surg. Lt. Col. George Sterling Ryerson,	Deputy Surg.-Gen., Canadian Militia, 60 College St., Toronto, Ontario.
1892	Generalmajor Johan Frederik Thaulow,	Sanitetsgeneral og Chef, Kongelige Regjerings Forsvars-Department, (Surg.-Gen., Royal War Ministry), Christiania, Norway.
1899	Lt. Commander Dr. Tomat Suri,	Surg., Imperial Japanese Navy, Tokio, Japan.
1892	M. G. M. F. Vanderlinden,	Inspecteur Général de Service de Santé Militaire, Saint-Josseten-Noode, Belgium.
1891	General Stabsarzt, Prof. Dr. von Bergmann,	Geheimer Med. Rath (Surg.-Gen., 1st Class Brig.-Gen.), Kriegs Ministeriums, Berlin, Germany.
1892	Excellenz, General Stabsarzt der Armee, Prof. Dr. von Coler,	Chef der Medizinal Abtheilung des Kriegs Ministeriums (Surg.-Gen., German Army, Chief of the Medical Section of the War Ministry, Maj.-Gen.), Kriegs Ministeriums, Berlin, Germany.
1891	General Stabsarzt, Prof. Dr. F. von Esmarch,	Geheimer Med. Bath (Surg.-Gen., 1st Class, Brig.-Gen.), Kiel, Germany.
1892	General Stabsarzt, Dr. Von Fichte,	Chef der Med. Abtheilung in Konigl. Wurttembergischen Kriegs Ministeriums, Surg.-Gen., 1st class, Chief of the Medical Section of the Royal Wurtemberg War Ministry. Stuttgart, Germany.
1892	Colonel Adolf Ziegler,	Médecin en Chef de l'Arméé fédérale, Suisse, Department Militaire, Berne, Switzerland.

HONORARY MEMBERS.

[In explanation of the presence in this list of gentlemen elegible to active membership, it may be stated that all such were elected prior to the adoption of the constitutional provision rendering them ineligible to honorary membership.]

ELECTED.		
1899	Barton, Miss Clara,	Pres. Am. National Red Cross Assn., Glen Echo, Md.
1894	Book, James B.,	Lt.-Col. and Surg.-Gen. (Ret.), M. S. T., 33 Campau Bldg., Detroit, Mich.
1894	Brinton, John H.,	Late Surg. U. S. Vols., 1423 Spruce St. Philadelphia, Pa.
1891	Byers, Frederick W.,	Brig.-Gen. and Surg.-Gen. (Ret.), Wis. N. G., Monroe, Wis.
1891	Egle, William Henry,	Maj. and Surg., N. G., Pa., State Library, Harrisburg, Pa.
1895	Flint, Austin,	Late Surg.-Gen. of New York, 603 34th St., New York, N. Y.
1892	Gihon, Albert Leary,	Med. Dir. Commodore (Ret.), U. S. N., Reform Club, New York, N. Y.
1899	Gould, Miss Helen,	Irvington-on-Hudson, N. Y.
1891	Henrotin, Fernand,	Maj. and Surg. (Ret.), I. N. G., 353 La Salle Ave., Chicago, Ill.
1897	Humiston, William H.,	Pres. Ohio State Medical Society, 122 Euclid Ave., Cleveland, O.
1891	Irwin, Bernard John Dowling,	Col. and Asst. Surg. (Ret.), U. S. A., Army Headquarters, Chicago, Ill.
1894	Keen, William Williams,	Late Act. Asst. Surg., U. S. A., 1729 Chestnut St., Philadelphia, Pa.
1892	Kimball, A. D.,	Maj. and Surg., Nat. Mil. Home, Ind., Marion, Ind.
1897	Kober, George M.,	Late Act. Asst. Surg., U. S. A., 1819 Q St. N. W., Washington, D. C.
1894	Love, Isaac Newton,	Lt.-Col. and Med. Dir. (Ret.), N. G. Mo., 49 W. 49th St., New York, N. Y.
1899	McGee, Dr. Anita Newcomb,	Late Dir. D. A. R. Hosp. Corps, Act. Asst. Surg., U. S. A., 1620 P St., Washington, D. C.
1892	McIntyre, John H.,	Maj. and Surg. (Ret.), N. G. Ind., 710 Olive St., St. Louis, Mo.
1899	Merrill, Mrs. John F.,	Pres. San Francisco Red Cross Society, San Francisco, Cal.
1894	Mills, Hiram R.,	Lt.-Col. and Surg.-Gen. (Ret.), Mich., Port Huron, Mich.
1895	Moore, John,	Brig.-Gen. and Surg.-Gen. (Ret.), U. S. A., 903 16th St. N. W., Washington, D. C.
1895	Murray, Robert,	Brig.-Gen. and Surg.-Gen. (Ret.), U. S. A., 47 E. 28th St., New York, N. Y.

ELECTED.		
1895	Page, Charles,	Col. and Asst. Surg.-Gen. (Ret.), U. S. A., 1216 Mount Royal Ave., Baltimore, Md.
1895	Park, Roswell,	Prof. of Surgery, Univ. of Buffalo, 510 Delaware Ave., Buffalo, N. Y.
1895	Smith, Joseph Rowe,	Col. and Asst. Surg.-Gen. (Ret.), U. S. A., 2300 Delancey Pl., Philadelphia, Pa.
1895	Tryon, James Rufus,	Med. Dir. (Capt.), U. S. N., New York, N. Y.
1900	Van Reypen, W. K.,	Rear-Admiral and Surg.-Gen., U. S. N., Washington, D. C.
1899	Walworth, Mrs. Ellen Hardin,	Pres. Woman's Nat. War Relief Assn., 251 W. 88th St., New York, N. Y.
1896	Wilson, Ezra Herbert,	Director of the Hoagland Laboratory, 194 Keap St., Brooklyn, N. Y.
1892	Wyman, Walter,	Supervising Surg.-Gen., U. S. M.-H. S., Washington, D. C.

DECEASED MEMBERS.

ACTIVE MEMBERS.

Adams. Charles W.,	Lt. and Asst. Surg., N. G.. Mo.
Armstrong, Francis Caldo,	Maj. and Surg., N. G., Kan.
Bates, Newton L.,	Surg.-Gen. (Commodore), U. S. N.
*Bergen, Andrew C.,	Lt.-Col. and Surg., N. G., Ia.
Boardman, Walter,	Lt. and Asst. Surg., N. G., Pa.
Browne, John Mills,	Surg.-Gen. (Commodore) (Ret.), U. S. N.
Eggers, John T.,	Capt. and Asst. Surg., N. G., Mo.
*Egle, William H.,	Maj. and Surg., N. G., Pa.
Etheridge, James H.,	Maj. and Brig. Surg., I. N. G.
Farquhar, Emmer C.,	Maj. and Surg., O. N. G.
Fisher, Walter W. R.,	Capt. and Asst. Surg., U. S. A.
Forster, Edward Jacob, *First Vice-Prest. 1896-97.*	Brig.-Gen. and Surg.-Gen., M. V. M.
*Gauntt, Franklin,	Lt.-Col. and Surg., N. G., N. J.
Halbert, J. E.,	Col. and Surg.-Gen., Miss. N. G.
Hamilton, John B.,	Ex-Surg.-Gen., U. S. M.-H. S., Ex-1st Lt. and Asst. Surg., U. S. A.
Hayes, Charles,	Lt.-Col. and Med. Dir., R. I. M.
Helm, Scott,	Col. and Surg.-Gen., N. G., Ariz.
Hope, James Shirley,	P. A. Surg. (Lt.), U. S. N.
Hutton, W. H. H.,	Surg., U. S. M.-H. S.
Jessup, Robert B.,	Col. and Surg.-Gen., N. G., Ind.
Leach, Hamilton E.,	Col. and Asst. Surg., N. G., D. C.
*Lincoln, Frank T.,	Maj. and Med. Insp., Ga. V.
Macauley, C. N. Berkeley,	Capt. and Asst. Surg., U. S. A.

* Died since last meeting.

DECEASED MEMBERS—Concluded.

ACTIVE MEMBERS.

Matthews, Frederick L., *Secretary 1892-93.*	Col. and Surg.-Gen., I. N. G.
McElderry, Henry,	Maj. and Surg., U. S. A.
*Miller, Truman W.,	Maj. and Surg., I. N. G.
*Mudge, Selden J.,	1st Lt. and Asst. Surg., N. G., N. Y.
Munday, Benj.,	Capt. and Asst. Surg., U. S. A.
Murphy, John Henry,	Brig.-Gen. and Surg.-Gen., N. G., Minn.
Ottilie, Charles,	Act. Asst. Surg., U. S. M.-H. S.
Pickman, H. Derby,	Brig.-Gen. and Surg.-Gen., N. G., Mont.
*Piggott, Michael R.,	P. A. Surg. (Lt. j. g.), U. S. N.
*Porter, Alexander S.,	Capt. and Asst. Surg., U. S. A.
*Read, Louis W., *Prest. 1895-96. First. Vice-Prest. 1894-95. Second Vice-Prest. 1893-94.*	Col. and Surg.-Gen., N. G., Pa.
Robinson, Samuel Quincy,	Maj. and Surg., U. S. A.
Rohé, George Henry,	Maj. and Surg., N. G., Md.
Sanborn, Perley Putnam,	Capt. and Asst. Surg., Ind. Inf. Legion.
Siegfried, Charles A.,	Surg. (Lt.), U. S. N.
Smith, Lawrence Savery,	Maj. and Surg., N. G., Pa.
Woodward, Charles Meredyth, *Second Vice-Prest. 1892-93.*	Lt.-Col. and Surg.-Gen., Mich. S. T.
Worthington, James Cheston,	Maj. and Surg., U. S. A.

ASSOCIATE MEMBERS.

*Grove, John H.,	Ex-Brev. Lt.-Col. and Surg., U. S. V.
Ordway, Albert,	Ex-Brig.-Gen., N. G., D. C.

CORRESPONDING MEMBERS.

Berenger, Feraud M.,	Med. Dir., Marine M. Service, France.
Bergin, Gen. Darby, M. P.,	Surg.-Gen., Canada.
Colin, M. Leon Jean,	Med. Insp.-Gen., France.
MacKinnon, Sir Wm. A., K. C. B.,	Maj.-Gen. and Dir. Gen., R. A. M. D. (Ret.)
Pecco, Giacomo,	Insp.-Gen., Army Med. Service, Italy.
Strange, Frederick Wm.,	Dep. Surg.-Gen., Canada.
Timmerman, M. R.,	Insp.-Gen., Army Med. Service, Holland.

HONORARY MEMBERS.

Leighton, Walter H.,	Maj. and Surg., U. S. A.
McClellan, Ely,	Lt.-Col. and Dep. Surg.-Gen., U. S. A.
Roth, Wilhelm A.,	Surg.-Gen., Saxony.
Sutherland, Charles,	Brig.-Gen. and Surg.-Gen., U. S. A.

*Died since last meeting.

LIST OF ACTIVE OR ASSOCIATE MEMBERS BY STATES OR SERVICE.

ALABAMA (2)

A. Festorazzi.
L. C. Morris.

ARIZONA (3)

D. J. Brannen.
H. E. Stroud.
W. Wylie.

ARKANSAS (1)

J. M. Keller.

ARMY (75)

G. W. Adair.
C. H. Alden.
D. M. Appel.
D. Bache.
J. M. Banister.
H. P. Birmingham.
W. C. Borden.
A. E. Bradley.
J. Brooke.
C. C. Byrne.
E. C. Carter.
J. T. Clarke.
G. L. Edie.
C. E. B. Flagg.
W. H. Forwood.
E. B. Frick.
B. E. Fryer.
C. M. Gandy.
E. F. Gardner.
R. J. Gibson.
A. C. Girard.
J. D. Glennan.
G. C. M. Godfrey.
H. S. T. Harris.
P. F. Harvey.
V. Havard.
C. L. Heizmann.
J. Van R. Hoff.
D. C. Howard.
F. J. Ives.
J. R. Kean.
F. M. Kemp.
W. P. Kendall.
H. S. Kilbourne.
J. P. Kimball.
W. L. Kneedler.
J. S. Kulp.
L. A. LaGarde.
H. Lippincott.
W. F. Lippitt.
C. F. Mason.
L. M. Maus.
J. V. D. Middleton.
E. L. Munson.
G. J. Newgarden.
W. O. Owen.
H. O. Perley.
J. L. Phillips.
J. E. Pilcher.
J. D. Poindexter.
B. F. Pope.
J. L. Powell.
W. E. Purviance.
H. I. Raymond.
W. Reed.
F. P. Reynolds.
C. Richard.
W. C. Shannon.
J. O. Skinner.
C. Smart.
W. Stephenson.
G. M. Sternberg.
H. R. Stiles.
L. S. Tesson.
G. H. Torney.
W. J. Wakeman.
W. E. Waters.
C. Willcox.
J. S. Wilson.
W. H. Wilson.
M. W. Wood.
A. A. Woodhull.
C. E. Woodruff.
E. Woodruff.
M. C. Wyeth.

CALIFORNIA (4)

P. J. H. Farrell.
G. F. Hanson.
W. E. Hopkins.
W. D. McCarthy.

ASSOCIATE MEMBERS (2)

W. F. Southard.
W. J. Younger.

COLORADO (6)

R. W. Corwin.
E. H. Fish.
W. W. Grant.
R. K. Hutchings.
L. H. Kemble.
C. Parkhill.

CONNECTICUT (13)

L. B. Almy.
J. M. Benedict.
J. F. Calef.
P. Cassidy.
G. B. Cowell.
C. C. Godfrey.
J. La Pierre.
A. W. Phillips.
T. F. Rockwell.
H. B. Thomson.
J. H. Townsend.
D. M. Trecartin.
W. S. Watson.

DISTRICT OF COLUMBIA (3)

W. D. Fales.
R. A. Foster.
C. A. Weaver.

FLORIDA (3)

R. P. Izlar.
J. Y. Porter.
E. L. Stewart.

ILLINOIS (25)

C. Adams.
F. Anthony.
A. C. Czibulka.
C. G. Fuller.
J. R. Hoffman.
H. Hooper.
J. N. Hyde.
A. L. Mann.
G. W. Mahoney.
T. C. McCord.
R. C. J. Meyer.
H. Richings.
T. E. Roberts.
J. Rowe.
N. Senn.
W. N. Senn.
J. B. Shaw.

ILLINOIS—Continued.
W. L. Smith.
S. C. Stanton.
J. W. Streeter.
T. J. Sullivan.
C. B. Walls.
A. A. Wesley.
W. S. White.
W. G. Willard.

ASSOCIATE MEMBER (1)
C. Truax.

INDIANA (1)
O. S. Runnels.

IOWA (7)
J. M. Barstow.
F. H. Little.
W. E. H. Morse.
J. T. Priestley.
C. M. Robertson.
B. H. Stover.
A. L. Wright.

ASSOCIATE MEMBER (1)
J. Hamilton.

KANSAS (2)
W. F. de Niedman.
F. E. Dillenbeck.

ASSOCIATE MEMBERS (2)
R. R. Hunter.
F. H. Martin.

KENTUCKY (1)
T. P. Grant.

LOUISIANA (1)
F. E. Artaud.

MAINE (4)
B. F. Bradbury.
G. M. Elliott.
W. J. Maybury.
F. C. Thayer.

MARINE HOSPITAL SERVICE (12)
G. H. Altree.
H. W. Austin.
W. H. Marsh.
T. B. McClintic.
R. D. Murray.
C. T. Peckham.
F. I. Phillips.
H. W. Sawtelle.
G. W. Stoner.
J. Tuttle.
G. T. Vaughan.
C. P. Wertenbaker.

MARYLAND (3)
G. L. Taneyhill.
J. D. Iglehart.
R. B. Warfield.

ASSOCIATE MEMBER (1)
E. Geer.

MASSACHUSETTS (18)
E. H. Abbe.
G. W. Allen.
A. Ames.
R. E. Bell.
R. A. Blood.
O. J. Brown.
W. Cogswell.
H. S. Dearing.
W. H. Devine.
C. C. Foster.
C. M. Green.
F. C. Hersey.
O. H. Marion.
W. L. Richardson.
W. A. Rolfe.
J. E. Simpson.
M. Standish.
J. C. Stedman.

ASSOCIATE MEMBER (1)
F. H. Osgood.

MICHIGAN (2)
C. D. W. Colby.
W. F. Hake.

ASSOCIATE MEMBER (1)
O. Le Seure.

MINNESOTA (11)
A. W. Allen.
E. Boeckmann.
T. C. Clark.
G. M. Coon.
C. E. Dutton.
R. J. Fitz Gerald.
A. F. Goodrich.
H. P. Ritchie.
A. J. Stone.
E. H. Whitcomb.
C. A. Wheaton.

MISSOURI (14)
C. S. Austin.
A. S. Barnes.
R. Barney, Jr.
E. Chancellor.
C. H. Dixon.
J. D. Griffith.
G. Halley.
N. O. Harrelson.
J. N. Jackson.
C. Pesold.
W. T. Stark.
H. Tuholske.
M. B. Ward.
C. E. Wilson.

ASSOCIATE MEMBERS (4)
W. A. Adams.
M. Moore.
E. Sander.
J. W. Trader.

MISSISSIPPI (1)
B. A. Vaughan.

MONTANA (2)
J. S. Hammond.
C. P. Hough.

NAVY (50)
H. E. Ames.
F. Anderson.
W. F. Arnold.
J. W. Baker.
G. H. Barber.
F. L. Benton.
D. N. Bertolette.
H. G. Beyer.
N. J. Blackwood.
R. S. Blademan.
J. C. Boyd.
R. Boyd.
G. P. Bradley.
R. G. Brodrick.
C. D. W. Brownell.
D. N. Carpenter.
F. C. Cook.
R. P. Crandall.
E. Z. Derr.
S. H. Dickson.
A. Farenholt.
M. F. Gates.
F. V. Greene.
A. G. Grunwell.
M. S. Guest.
J. A. Guthrie.
R. M. Kennedy.
P. Leach.
C. H. T. Lowndes.
R. A. Marmion.

NAVY—Continued

J. M. Moore.
L. Morris.
O. D. Norton.
G. Peck.
H. T. Percy.
R. C. Persons.
F. L. Pleadwell.
T. L. Rhoads.
T. W. Richards.
P. M. Rixey.
W. K. Scofield.
E. M. Shipp.
G. T. Smith.
R. K. Smith.
F. B. Stephenson.
E. R. Stitt.
F. W. F. Wieber.
G. B. Wilson.
J. C. Wise.
G. W. Woods.

NEBRASKA (4)

C. G. Barns
E. A. Carr.
E. W. Lee.
G. L. Pritchett.

ASSOCIATE MEMBER (1)

O. Grothan.

NEVADA (1)

S. L. Lee.

NEW HAMPSHIRE (2)

G. Cook.
E. H. Currier.

ASSOCIATE MEMBER (1)

J. F. Robinson

NEW JERSEY (9)

C. F. Adams.
H. Allers.
G. Bayles.
A. C. Dougherty.
L. L. Glover.
E. L. B. Godfrey.
C. F. W. Myers.
G. W. Terriberry.
D. L. Wallace.

ASSOCIATE MEMBERS (2)

R. A. Donnelly.
B. W. Spencer.

NEW YORK (33)

M. C. Ashley.
L. Balch.
W. N. Belcher.
A. H. Bogart.
A. H. Briggs.
H. Brooks.
C. E. Bruce.
A. F. Brugman.
J. D. Bryant.
W. F. Campbell.
C. P. Cook.
C. W. Crispel.
H. P. de Forest.
G. R. Fowler.
N. H. Henry.
J. H. Huddleston.
C. W. Jackson.
A. R. Jarrett.
N. S. Jarvis.
F. J. Kaufman.
R. J. Kingston.
J. C. MacEvitt.
H. Mead.
S. D. Powell.
F. H. S. Ritter.
C. C. Schuyler.
W. H. Skene.
T. B. Spence.
M. O. Terry.
H. Wallace.
J. P. Warbasse.
F. J. J. Wood.
G. W. York.

ASSOCIATE MEMBERS (8)

M. J. Asch.
W. Goetz.

BOARD OF OFFICERS, 65th REG.

G. B. Lee.
T. H. Manley.
F. W. Murray.
L. L. Seaman.
C. Wagner.

NORTH CAROLINA (4)

S. W. Battle.
T. S. Burbank.
C. S. Jordan.
J. H. Williams.

NORTH DAKOTA (1)

O. W. Archibald.

OHIO (25)

G. C. Ashmun.
W. F. Brokaw.
E. C. Brush.
F. E. Bunts.
C. H. Castle.
J. H. Dickerson.
J. J. Erwin.
D. K. Gotwald.
L. T. Guerin.
F. Gunsaulus.
F. W. Hendley.
W. A. Hobbs.
G. H. Jones.
J. E. Lowes.
J. B. McComb.
H. McI. W. Moore.
A. L. Osborne.
D. A. Rannels.
P. S. Rieg.
W. H. Rothert.
A. V. Smith.
W. L. Taylor .
H. E. Twitchell.
W. A. Westervelt.
S. B. Wright.

ASSOCIATE MEMBERS (6)

P. S. Connor.
C. S. Hamilton.
H. A. Hart.
A. K. A. Liebich.
H. W. Whitaker.
W. E. Wirt.

PENNSYLVANIA (35)

W. M. Angney.
H. A. Arnold.
W. J. Ashenfelter.
W. H. Baker.
J. L. Brubaker.
H. Burgin.
W. H. Daly.
F. E. Drumheller.
K. A. Emmerling.
C. H. Frazier.
G. H. Halberstadt.
R. G. H. Hayes.
R. S. Huidekoper.
J. Johnston.
W. McC. Johnston.
A. A. E. McCandless.
E. Martin.
S. C. Milligan.
C. H. Miner.
R. W. Montelius.

PENNA.—Continued

J. W. O'Neill.
J. M. Peters.
G. F. Potteiger.
B. S. Ralston.
R. P. Robins.
J. V. Shoemaker.
J. E. Silliman.
J. L. Srodes.
A. S. Stayer.
W. S. Stewart.
A. G. Thomson.
C. S. Turnbull.
J. M. B. Ward.
J. K. Weaver.
J. W. Wright.

ASSOCIATE MEMBERS (4)

B. Brooke.
H. E. Gettier.
H. Morris.
J. K. T. Van Pelt.

RHODE ISLAND (13)

C. F. Barker.
W. F. Barry.
J. C. Budlong.
G. W. Carr.
C. M. Cole.
G. H. Crooker.
F. L. Day.
C. H. French.
N. D. Harvey.
G. H. Kenyon.
W. J. McCaw.
C. F. Peckham.
J. L. Wheaton.

ASSOCIATE MEMBER (1)

J. F. Haller.

SOUTH CAROLINA (1)

F. D. Kendall.

SOUTH DAKOTA (3)

F. S. Ledeboer.
G. A. Pettigrew.
H. S. Sevey.

UTAH (1)

G. H. Penrose.

VERMONT (3)

G. C. Berkley.
J. N. Jenne.
O. W. Peck.

VIRGINIA (3)

C. V. Carrington.
D. A. Kuyk.
W. D. Turner.

WASHINGTON (2)

L. R. Dawson.
J. B. Eagleson.

WEST VIRGINIA (4)

C. B. Blubaugh.
C. Gilham.
D. Mayer.
F. W. Smith.

WISCONSIN (8)

R. Chandler.
J. B. Edwards.
T. W. Evans.
E. H. Grannis.
J. R. McDill.
J. Whiting.
F. J. Wilkie.
W. W. Wilson.

WYOMING (1)

R. H. Reed.

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